P/
Tech
F

JOURNAL

OF

THE FRANKLIN INSTITUTE,

OF THE

State of Pennsylvania,

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE, CIVIL ENGINEERING, THE ARTS AND MANUFACTURES, AND THE RECORDING OF AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED BY
JOHN F. FRAZER,
Assisted by the Committee on Publications of the Franklin Institute.

THIRD SERIES.
VOL. XXVII.
WHOLE NO. VOL. LVII.

PHILADELPHIA:
PUBLISHED BY THE FRANKLIN INSTITUTE, AT THEIR HALL.

1854

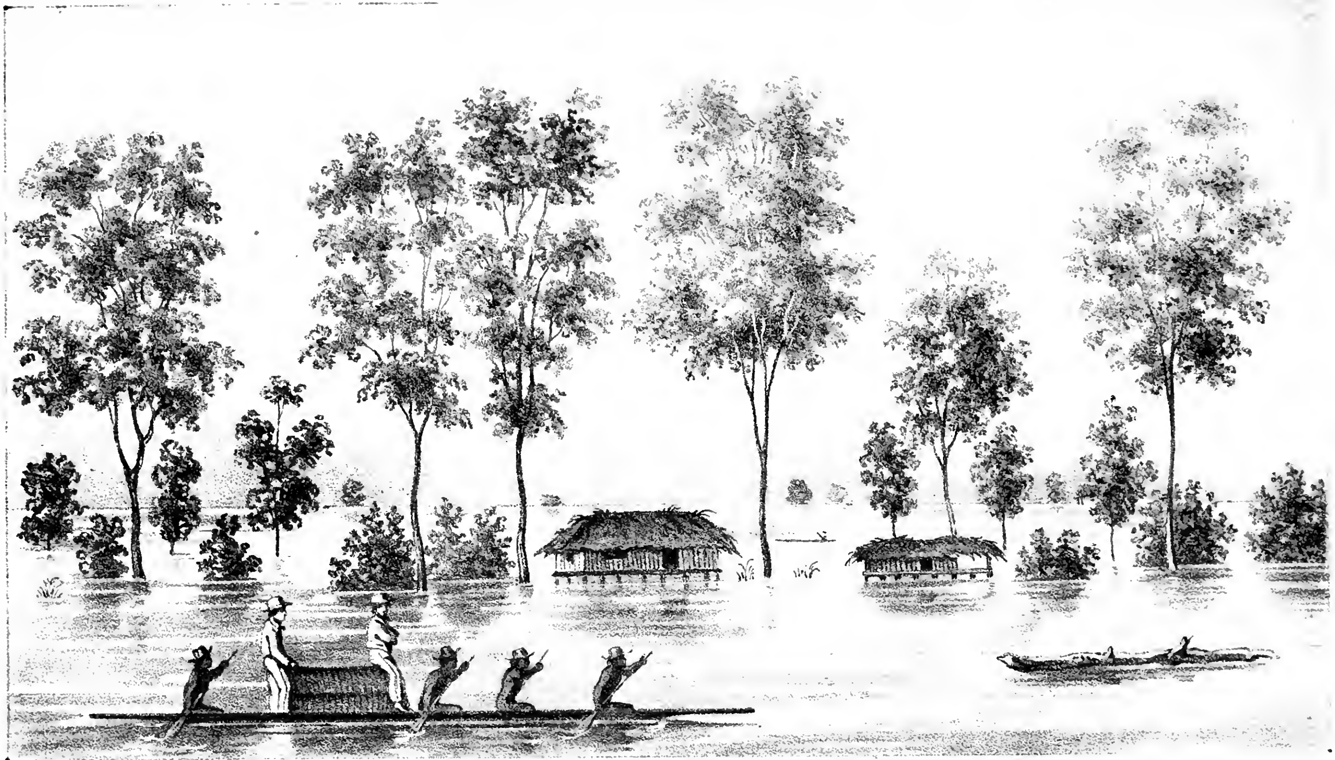
TURBO OR PISISI.

ENTRANCE TO CAÑO COQUITO.

J. C. T. delt

P. S. Duval & Co's Steam lith. Press Philada

VIGÍA CURBARADÓR.



J. C. T. delt

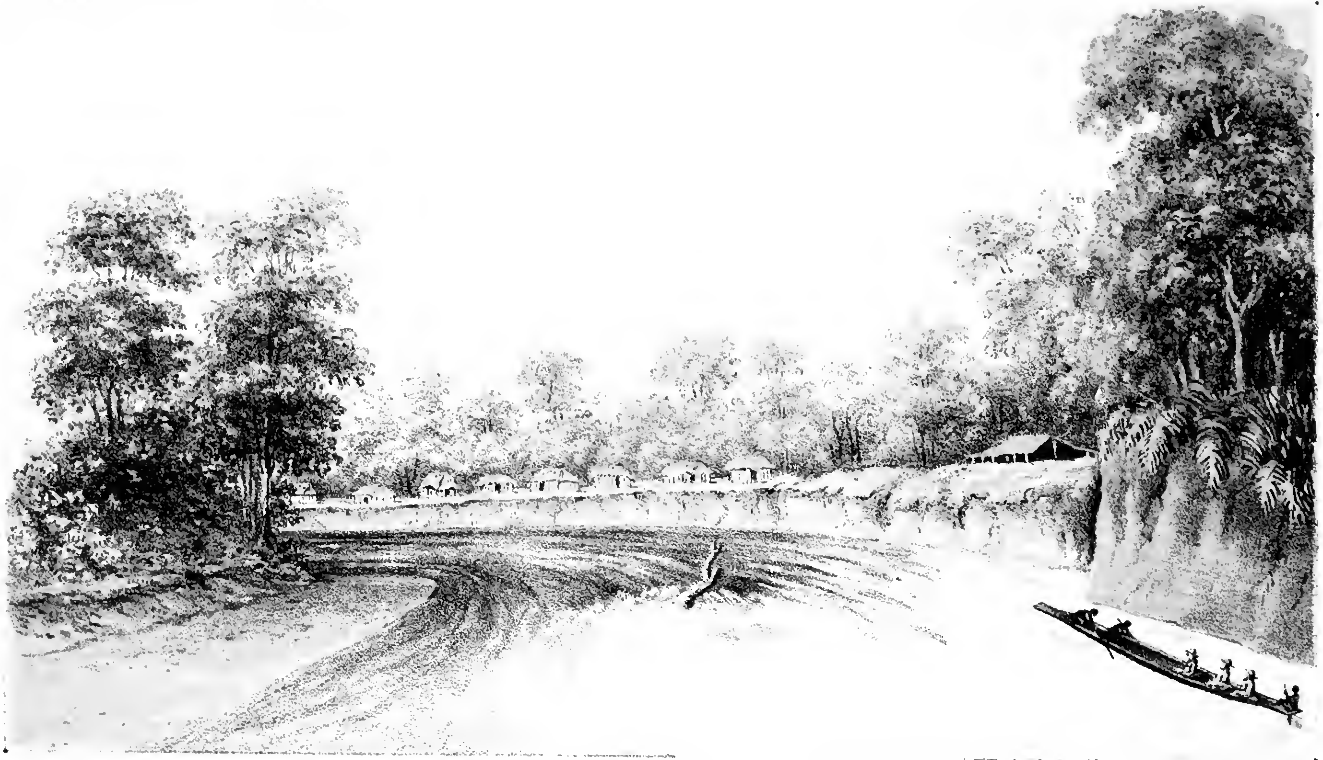
P. S. Duval & Co's Steam lith Press Philada

OVERFLOW OF THE LEVEES.

J. C. T. delt

P. S. Duval & Co's Steam lith. Press Philada

TEVÁDA.



J. C. T. delt

P. S. Duval & Co's Steam lith Press Philada

MURRÍ.

J C T del.

P. S. Duval & Co's Steam lith. Press Philad.

QUIBDÓ.

J C T del[t]

P.S. Duval & Co's Steam lith Press Philad[a]

VIEW IN QUIBDÓ.

[illegible]

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JANUARY, 1854.

CIVIL ENGINEERING.

*Norris's Railway Joint Chair.**

The following paper on Mr. Norris's new joint chair was read at the last meeting of the Institution of Mechanical Engineers at Birmingham:

In bringing before the Institution a plan for a new kind of joint chair for railways, it will be unnecessary to expatiate on the advantages of a *firm joint*, as regards economy of maintenance of the road and rolling stock, and safety.

The object of this paper is to describe a method which has been in use on a crowded part of the London and North-Western Railway for above eighteen months, during which time it has stood well, and is now being extensively used on the same line.

The plan is to cast a chair or coupling on the rails at the joints as they lie in the line, by means of chills and a portable cupola. The hot metal flowing freely into the chill is allowed to come in close contact with the rails, and in cooling contracts so as to grip the ends of the rails firmly together. The great object to be attained is the converting of the rail into a continuous girder, which shall not deflect at the joint more than at any other part; every successive year's experience having forced the attention of engineers and others to this point, to attain which many plans have been tried with more or less success.

Whatever mode of joint is adopted, or whatever method of jointing the ends of rails, it is necessary that a certain allowance should be made for the longitudinal motion caused by the expansion and contraction of the rail. This object is attained, wherever necessary, by putting the chills, previously heated, on the ends of the rails for a short time, until they become hot, when they are taken off, and a thin wash of loam and

* From the London Mechanic's Magazine, October, 1853.

blacking is laid upon the rail end, which instantly dries on, and when the melted iron is poured against it, absolute contact with the rail is prevented. Although provision is thus made for the expansive and contractile force of the rail, the cavity in the chair being parallel to the rail, clips it sufficiently tight to prevent any vertical or lateral motion of the rails; the amount of surface of contact between the rail and chair is about 100 square inches, being 50 square inches to each rail end.

This great surface prevents any perceptible wear taking place on the rail-ends from the longitudinal motion of expansion; and as no motion can take place vertically or laterally, no shock can take place by the action of the wheels, so that the joint will remain good for years, which has been confirmed by practice, so far as it has gone.

The operation of casting is very simple, and is performed without hindering the pacing of trains during the execution of the work.

The apparatus consists of chills and a portable cupola, and the process is as follows, when operating on a line already laid:—Each joint-sleeper or block is first lowered by the plate-layers about three inches, so as to give room for the application of the chills, or is removed altogether for the time, and the old chair being taken off the joint, the chills are applied, consisting of a bed plate with two lips, one on each side, holding down the side-chills, which slide in the grooves; these are put to the rail and held together by screw-clips, forming a mould for casting the chair. This operation is quickly performed, and the chill is then packed under temporarily with loose metal plates; the moment this is done a train may pass over it without hindrance.

Two steel pins are then put in their places in the chills, so as to form the cores for the holes of the holding-down spikes. The chill mould being thus fastened in its place, is ready for the melted metal, which is run into it at the lip, until it is level with the top of the sides, where a large open space is left for the escape of air, which prevents all possibility of blowing.

The chills are made to fit the rails by projections at each end, which grip the rail firmly, and a little loam is applied on the outside, to prevent the hot metal making its way out of the chill-mould.

After a lapse of about five minutes the mould is taken off, which is done in an instant, leaving the chair perfect, and closely embracing the contiguous ends of the rail. The form of this chair is such as to make it a strong and rigid clip, closely fitting the two ends of the rail along its whole length. Chairs may by this method be cast of any form. When the chair is cold enough, the sleeper or block is replaced, and the chair spiked to it.

The operation is the same in relaying new roads, only that the expense of lowering or removing the block or sleeper is saved.

The metal used up to the present time has consisted of old chairs, mixed with a little new iron. This is melted in a portable cupola, formed of a cylinder of sheet-iron $\frac{1}{16}$th of an inch thick, 2 feet 3 inches in diameter, and 4 feet 6 inches high, lined with fire bricks and clay in the usual manner, 4 inches thick.

The cupola weighs about 6 cwt., and is easily lifted by the workmen on to a plate-layer's lorry, and taken to the place required, when it is

lifted off, and placed on a few sleepers laid on the slope of a cutting or embankment. When once so placed it will serve for half a mile of road without moving again, as the metal is so hot as to enable its being taken, in a moulder's ladle, on a lorry, to the chills at a quarter of a mile on each side the cupola.

The cupola has a belt or air chamber, into which passes the air from the fan, and it has four tuyeres of two inches' orifice to admit the air to the fire. The fan consists of a chamber 1 foot 10 inches inside diameter and 9 inches wide, and weighs about 3 cwt.; it is detached from the cupola by drawing out the nozzle from the entrance to the air belt, and can then be lifted separately into its place. The fan is either turned by hand-winches, or, when the operations are extensive, by a small steam-engine, weighing about 10 cwt., and can be lifted by eight men, and placed on and off a lorry, and on the slope, in the same manner as the cupola.

The yield of metal from so small a cupola is very great: as much as $3\frac{1}{2}$ tons has been run down in seven hours, by two men turning the handles of the fan, and nearly $4\frac{1}{2}$ tons by the use of the engine in the same time.

A smaller cupola, weighing about 2 cwt., is used for repairs of the line.

A good fastening is made for middle chairs by taking out the wooden key from the common middle chair, and casting an iron one in its place. This is done by heaping dry sand around the chair, as it stands in its place, and then running metal into the cavity so formed, leaving a lip projecting over the chair. Only a few of these have yet been put down; but they have stood the test of two years' working over without failure, and are still tight. In casting, the hot metal running into the chair expands it, and its contracting upon the cast key in cooling makes it tight.

It may be remarked, that the new chair occupies exactly the same position on the sleepers, and has the same fixing, as the common joint-chair; so that in case of damage to the line from accident or slips, it can be repaired quickly in the ordinary manner, by using the old chairs and wood keys until the small cupola can be brought to bear.

Mr. Norris exhibited specimens of the chairs and the cast iron mould, complete; also a specimen of one of the new joint-chairs from the North Union Railway, which had been laid down for eighteen months in a line of great traffic, where 500,000 wheels had passed over it during the time; the two rail ends were cut off, and remained fixed fast in the chair, and the surface of the joint was level and smooth, although the rail ends had been much indented at the time the chair was cast on, from the rails having been recently turned.

The Chairman inquired what length of line had been tried with the new chairs, and how long they had been at work?

Mr. Norris replied, that five miles had been recently laid with these chairs near Rugby, and about a mile was previously laid near Crewe, and elsewhere, which had mostly been at work one and a half years.

Mr. Woodhouse said, the recent trial of the chairs near Rugby had been made under his superintendence, and he had found the result highly satisfactory. It had been intended to relay that portion of the line during the present summer; but the new joint-chairs had proved of such benefit,

that they would probably give several years additional life to that road. He consequently recommended the adoption of the plan on a considerable length at other parts of the line, which was now in progress.

The Chairman asked what difference was felt in the trains running over the joints on the portion that had been altered at Rugby?

Mr. Woodhouse said, the joints could not be felt at all with the new chairs; there was no comparison of the case in traveling over the old plan of joints.

The Chairman asked what was the usual time required for the process of casting the chairs?

Mr. Woodhouse replied, that the average of the work done at Rugby was about one chair cast every four minutes, including the whole process of preparation.

Mr. Slate remarked, it was certainly a very ingenious process of casting the chairs, and must make a thoroughly firm joint; he inquired what was the expense of casting?

Mr. Norris said that the labor of casting cost about 6d. per chair, and the cost was about 1s. per chair, including all expenses except the metal, which weighed about 50 lbs. The expense of casting was much diminished as the men got more experienced in managing it. At first they could only cast 40 chairs per day, but the rapidity of casting increased with practice to 80 per day; and now 120 per day were cast by common plate-layers, who had never before had anything to do with melted iron.

Mr. Slate said he had seen the first of these chairs one and a half years since, and had then an unfavorable opinion of their standing in work from the great contraction of the melted metal in cooling on the rigid rail; but it appeared that the wrought iron rail was expanded by the heat of the melted metal sufficiently to make the chair safe by its contraction again in cooling. He thought the new chair made a very perfect coupling of the rail ends, and was a great improvement on fishings and other plans, which he could only regard as makeshifts; and though they had a very good effect compared with the previous plan of having nothing to couple the rails together at the joints, they were still far removed from perfection. The new chair might be said to be quite perfect, if it could be made quite fast on the rail without allowing it to slide.

Mr. Norris observed, that only every third or fourth joint was made a slip joint for expansion; he was aware what a great advantage it would be to have no slip-joints, and by no means maintained that to be impracticable; the expansion of the rails successively by the heat of casting the chairs on, would perhaps elongate them sufficiently to make provision for the expansion from the highest temperature they would be afterwards exposed to, and the tension would then resist the contraction from cold.

Mr. May remarked, that Mr. Brunel had now many miles' length of Barlow's rail on the South Wales Railway, all riveted fast together, without any provision for expansion, and no difficulty was experienced in consequence. There was some misconception on this point, respecting the action of expansion; it was limited in amount of force, and if opposed by a greater force, no amount of expansion or contraction could take place. Wrought iron raised in temperature 15° was expanded $\frac{1}{10000}$th

of its length, and exerted a force of 1 ton per square inch of section by the expansion; consequently, no expansion of the rails would take place if a resistance were opposed of 1 ton per square inch for each 15° rise of temperature. He thought it probable that Mr. Norris's plan ultimately would require to have no expansion joints to perfect it, and in many cases he did not doubt the plan being an excellent one.

Mr. James Nasmyth said he had witnessed the whole process of casting the chairs, and fitting on the iron moulds, and considered it a very successful plan, and of the utmost value and importance to the durability of the line as well as to the safety of the public. The trains ran full speed over the red hot chairs directly after they were cast. He thought the slight tortuosities of all roads, even in the straight parts, would be probably found sufficient to allow for the effect of expansion, without making any provision of slip joints.

Mr. May suggested, that an experiment could readily be tried to ascertain the actual amount of expansion of the rails, by having a number of thin graduated wedges, to be dropped into the joints at the hottest part of the day and at night, to measure the amount of expansion over a considerable length of rail. It would probably be found to be very insignificant, as the ordinary chairs offer a considerable resistance to a longitudinal motion of the rail, by the hold of the keys on the rail, the chairs on the keys, and the ground on the sleepers; though of course the resistance in Barlow's rail was a different case, where the rail, chair, and sleeper were all one.

Mr. Woodhouse remarked, that in laying the rails the men place small wooden or iron packing pieces, $\frac{1}{16}$th of an inch thick, between the rail ends at the joints, to make the ordinary allowance for expansion; and they always find that if these pieces are put in early in the day, they become so tight in the middle of the day that they cannot be got out, but are quite loose in the cool of the evening.

The Chairman observed, there was no doubt the expansive action of the heat would always produce its full effect, either by compressing the iron of the rails, or producing some motion or distortion in their position.

Mr. Norris said, that cases had occurred of the road becoming hog-backed, rising with the sleepers out of the ballast, from the want of sufficient allowance for expansion; also in curves, the rails and sleepers had been pushed bodily outwards in the ballast by the effect of expansion. The extreme change of length in this country, from 80° or 90° variations of temperature, amounted to a yard per mile, and this yard length must be disposed of somewhere in each mile, either by sliding or tension, or else by bending upwards or laterally, if there was not less resistance to compression of the iron.

Mr. C. Cowper remarked, that the extreme change of temperature of 90° would cause a total strain on the iron of 6 tons per square inch, at 1 ton for 15°, which amounted to the very severe total force of 40 or 50 tons on the whole sectional area of the rail of 7 or 8 square inches, to overcome any supposed resistance.

Mr. May thought the change of temperature in the rails would be considerably less than that of the air, because they were partly buried in the

ground, and must therefore follow the temperature of the surface of the earth, which fluctuated much less than that of the air.

Mr. Duclos remarked, that the expansion or contraction of the rails would only take place from the mean temperature to the maximum or minimum; and as the mean temperature of the air in this country was about 50°, and the maximum 90°, making a change in the air of 40°, the actual change in the rails from the mean temperature was probably less than 30°, causing a strain of not more than 2 tons per inch expansion or contraction.

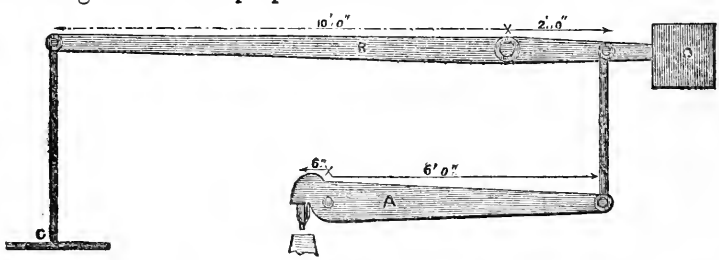
The Chairman observed, it was an important subject for consideration, whether the allowance for expansion could be entirely dispensed with; and the new chair appeared an important step in that direction, and might lead to doing away with longitudinal bearings.

Mr. Norris said that his attention had been first directed to the subject of this chair about two years since, by the circumstance of a very extensive alteration having been in contemplation from the ordinary rail and cross sleepers to a bridge rail on longitudinal timbers, the alteration being proposed entirely on the ground of obtaining a superior coupling of the joints with the longitudinal bearing than the ordinary rail and chair. But he objected to the bridge rail and longitudinal timbers as more expensive; and the idea then occurred to him of running the melted metal into the chairs to fill them up solid, and make a rigid coupling of the joint; and this led him to casting the joint-chairs solid upon the rails in their places, as the complete way of carrying out the object.

---

*Table of Pressures necessary for Punching Plate Iron of various thicknesses.**

The following table exhibits the results of a series of experiments made some time ago at the Great Western Steam Ship Works, Bristol, for the purpose of determining the actual pressure necessary for perforating wrought iron plates of various strengths. The trials were conducted in the most careful manner by Mr. John Jones, the inventor of the Cambrian engine, the lever punching press delineated in the annexed diagram being used for the purpose.



The first lever, A, is 6 feet 6 inches long, with its fulcrum 6 inches from one end, so that its leverage is as 12 to 1. The second lever, B, is 12 feet long, with one arm of 2 feet, making 5 to 1. Hence the gain in leverage $= 12 \times 5 = 60$ times; so that 1 cwt. on the scale is equal to 3 tons on the punch. The punching weights are hung on the scale, at C, and at D is a back balance.

* From the London Practical Mechanic's Journal, November, 1853.

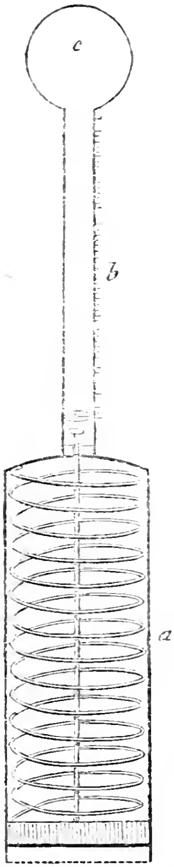
Diam. of Pun.	Thick. of Plate.	Weight in the Scale.			Pressure on the Punch.			
In.	Wire Gua.	Cwt.	qrs.	lbs.	Tou.	Cwt.	qrs.	lbs
1/8	16	0	1	17½	1	4	1	14
1/8	16	0	1	16½	1	3	3	10
1/8	15	0	2	2½	1	11	0	23
1/8	15	0	2	1	1	10	1	4
1/8	15	0	1	26½	1	9	1	9
1/8	14	0	2	12	1	16	1	16
1/8	14	0	2	8	1	14	1	4
1/8	14	0	2	13¾	1	17	1	5
1/8	13	0	3	5½	2	7	3	12
1/8	13	0	3	6	2	8	0	14
1/8	13	0	2	16	1	18	2	8
1/8	13	0	2	14	1	17	2	0
1/8	12	0	2	21½	2	1	2	2
1/8	12	0	2	19	2	0	0	20
1/8	12	0	2	20½	2	0	3	26
1/8	11	0	2	23	2	2	1	8
1/8	11	0	2	25	2	3	1	16
1/8	11	0	2	24¾	2	3	1	1
1/8	10	0	2	27	2	4	1	24
1/8	10	0	3	0	2	5	0	0
1/8	10	0	2	25½	2	3	2	18
1/8	9	0	3	8	2	9	1	4
1/8	9	0	3	7	2	8	3	0
1/8	9	0	3	8¼	2	9	1	19
1/8	8	0	3	26	2	16	1	20
1/8	8	0	3	25	2	18	1	16
1/8	8	0	3	23	2	17	1	8
1/8	8	0	3	24	2	17	3	12
1/8	7	1	0	1¼	3	0	2	19
1/8	7	1	0	1¼	3	0	2	19
1/8	7	1	0	2¼	3	0	4	23
1/8	6	1	0	11	3	5	3	16
1/8	6	1	0	14	3	7	2	0
1/8	5	1	0	26½	3	11	2	22
1/8	5	1	1	4¼	3	17	1	3
1/8	5	1	1	2¾	3	16	1	25
1/8	4	1	1	1	3	15	2	4*
	Inch							
1/4	1/8	1	0	18¼	2	9	3	3
1/4	1/8	1	0	15	3	8	0	4
1/4	1/8	1	0	13	3	6	3	24
1/4	1/8	1	0	11½	3	6	0	18
1/4	3-16	1	1	24	4	7	3	12
1/4	3-16	1	2	2	4	11	0	8
1/4	3-16	1	1	18	4	4	2	16
1/4	1/4	1	3	26	5	18	3	20
1/4	1/4	2	0	8½	6	4	2	6
1/4	1/4	2	0	0	6	0	0	0
1/4	5-16	2	0	3	6	1	2	12
1/4	5-16	2	0	15	6	8	0	4
1/4	5-16	2	0	14	6	7	2	0
1/4	3/8	2	2	21¾	7	1	2	17
1/4	3/8	2	2	15	7	18	0	4
1/4	3/8	2	2	15	7	18	0	4
1/4	7 16	2	3	11	8	10	3	16
1/4	7-16	2	3	8	8	9	1	4
1/4	7-16	2	3	5	8	7	2	20
1/4	1/2	3	1	1¼	9	15	2	9*
3/8	1/4	2	2	15¼	7	18	0	19
3/8	1/4	2	2	17	7	19	0	12
3/8	1/4	2	2	19	8	0	0	20
3/8	5-16	3	0	0	9	0	0	0
3/8	5-16	3	0	8	9	4	1	4
3/8	5-16	3	0	10	9	5	1	12
3/8	3/8	4	0	5	12	2	2	20
3/8	3/8	4	0	0	12	0	0	0
3/8	3/8	4	0	14	12	7	2	0
3/8	7-16	4	2	5	13	12	2	20*
1/2	1/8	1	3	22	5	16	3	4
1/2	1/8	1	3	26½	5	19	0	22
1/2	1/8	1	3	23	5	17	1	8
1/2	3-16	2	2	16½	7	18	3	10
1/2	3-16	2	2	18¼	7	19	3	3
1/2	3-16	2	2	12	7	16	1	20
1/2	1/4	3	2	21	11	1	1	0
1/2	1/4	3	2	11	10	15	3	16
1/2	1/4	3	2	20	11	0	2	24
1/2	5-16	4	0	18	12	9	2	16
1/2	5-16	4	0	20	12	10	[illegible]	24

Diam. of Pun.	Thick. of Plate.	Weight in the Scale.			Pressure on the Punch.			
in.	Inch.	Cwt.	qrs.	lbs.	Ton.	cwt.	qrs.	lbs
1/2	5-16	4	0	18	12	9	2	16
1/2	3/8	5	2	3	16	11	2	12
1/2	3/8	5	2	5	16	12	2	20
1/2	3/8	5	2	5	16	12	2	20
1/2	7-16	6	2	14	19	17	2	0
1/2	7-16	6	2	11	19	15	3	16
1/2	7-16	6	2	26	20	3	3	20
1/2	1/2	7	0	7	21	3	3	0
1/2	1/2	7	0	0	21	0	0	0
1/2	1/2	7	3	14	23	12	2	0
1/2	5/8	8	3	16	26	13	2	8†
1/2	5/8	8	3	21	26	16	1	0
1/2	11-16	8	3	7	26	8	3	0
1/2	11-16	8	3	18¼	26	14	3	3
1/2	11-16	8	3	14	26	11	3	24
1/2	3/4	10	1	19¼	31	5	1	7‡
5/8	1/4	4	1	1	12	15	2	4
5/8	1/4	4	1	15¼	13	3	0	19
5/8	1/4	4	1	7	12	18	3	0
5/8	3/8	7	0	7	21	3	3	0
5/8	3/8	7	0	14	21	7	2	0
5/8	3/8	7	1	0	21	15	0	0
5/8	1/2	8	3	14	26	12	2	0
5/8	1/2	8	3	7	26	8	3	0
5/8	1/2	8	3	8	26	9	1	4
5/8	5/8	11	1	11	34	0	3	16
5/8	5/8	11	0	0	33	0	0	0
5/8	5/8	10	3	21	32	16	1	0
5/8	3/4	12	0	0	36	0	0	0*
3/4	1/4	5	1	0	15	15	0	0
3/4	1/4	5	0	18	15	9	2	16
3/4	1/4	5	0	18	15	9	2	16
3/4	3/8	7	3	0	23	5	0	0
3/4	3/8	7	1	21	22	6	1	0
3/4	3/8	7	1	1½	22	2	2	0
3/4	1/2	9	1	14	28	2	2	0
3/4	1/2	9	1	11	28	0	3	16
3/4	1/2	9	1	17	28	4	0	12
3/4	5/8	11	1	24	34	7	3	12
3/4	5/8	11	1	0	33	15	0	0
3/4	5/8	11	2	10	34	15	1	12
3/4	3/4	14	3	7	44	8	3	0§
7/8	1/4	5	3	11½	17	11	0	18
7/8	1/4	6	0	11½	18	6	0	18
7/8	1/4	6	0	6	18	3	0	24
7/8	3/8	9	0	24	27	12	3	12
7/8	3/8	9	1	11	28	0	3	16
7/8	3/8	9	1	10	28	0	1	12
7/8	1/2	12	3	21	38	16	1	0
7/8	1/2	12	2	8	37	14	1	4
7/8	1/2	12	1	0	36	15	0	0
7/8	5/8	14	3	0	45	5	0	0
7/8	5/8	14	3	0	45	5	0	0
7/8	5/8	14	3	6	45	8	0	24
7/8	3/4	18	2	11	55	15	3	16
7/8	3/4	18	2	0	55	10	0	0
7/8	3/4	18	1	14	55	2	2	0
7/8	7/8	18	2	0	55	10	0	0‖
7/8	7/8	18	0	0	54	0	0	0‖
7/8	1	22	0	0	66	0	0	0¶
1	1/4	7	1	0	21	15	0	0
1	1/4	7	1	5	21	17	2	20
1	1/4	7	0	0	21	0	0	0
1	3/8	11	0	5	33	2	2	20
1	3/8	11	0	0	33	0	0	0
1	3/8	10	3	0	32	5	0	0
1	1/2	12	3	22	38	16	3	4
1	1/2	13	2	14	40	17	2	0
1	1/2	14	0	18	42	9	2	16
1	5/8	15	3	21	47	16	1	0
1	5/8	16	1	16	49	3	2	8
1	5/8	16	0	0	48	0	0	0
1	3/4	20	1	14	61	2	2	0
1	3/4	20	1	8	60	19	1	4
1	3/4	20	0	7	60	3	3	0
1	1	25	2	25	77	3	1	16¶

* Punch broke. † Die and punch broke. ‡ Die broke. § Punch bent and die broke. ‖ A piece of 7/8 bar iron, very soft, and too narrow for a true punch. ¶ Machine would not allow of a stronger piece being punched.

On an Instrument for taking Soundings. By F. Maxwell Lyte, Esq.*

Gentlemen—As I see, from what Dr. Scoresby has been saying before the Association at Hull, there seems to be some difficulty about obtaining a correct sounding in places where the currents are strong and flow in different directions at the different points of depth, causing the line to assume different curves in its descent; and when it comes to be measured over, after the weight has reached the bottom and been hauled up again, the measurement gives no approximate idea of the real depth,—now it is plain that this mensuration of the depth of water might be as well made by estimating its vertical pressure, as, in measuring the height of mountains, we measure the barometrical pressure of the air; and so I would propose to do it by an instrument constructed as follows:—



An accurately constructed tube of gun-metal or brass, or some metal not very easily corrodible by salt water, has a glass tube fitted on to it on the top by a screw joint, and again on the top of the glass tube is fitted a strong hollow copper ball by a similar screw joint. The lower tube, which we will call *a*, has a well turned piston fitted to it, from which runs a rod which is only a trifle longer than the tube *a*, and just enters the tube *b* when the piston is at its lowest point. A well made spring is placed in the tube *a* above the piston, and the tube *a* being narrowed at the top, so as just to admit the free passage of the rod, and the rod having a little button at its top, the piston is kept at its lowest point by the spring, except when sufficient pressure is applied from below to compress the spring. The glass tube has a small ring fixed in it, just so as to stick at any point to which it is pushed, and the button at the top of the rod serves to push the ring straight, and the ring thus forms an index of the degree to which the spring has been compressed. The ball on the top serves as a mere reservoir of air to equalize the action of the apparatus as much as possible. The whole of this apparatus is enclosed in a wire cage for the sake of protection from blows. To graduate this apparatus, I let it down in a known depth of water, say ten fathoms, and having observed the point to which the ring in the glass tube is pushed, and having marked this point off, the ball is to be unscrewed, and with a small ramrod the ring is to be pushed down till it rests on the top of the piston rod. The ball being replaced, the apparatus is sunk in twenty fathoms; after a similar manner it is sunk in thirty, and next in forty fathoms. This will test the accuracy of the apparatus: and the marks made on the glass tube *b* after each trial will give a scale from which the whole tube may be graduated, even to thousands of fathoms, if the tube be long

* From the London, Edinburgh, and Dublin Philos. Magazine, November 1853.

enough or the spring strong enough. I have been induced to make this communication on account of the great use which may be made of such an apparatus.

Florian, Torquay, September 19.

Communication of the Board of Directors of the Panama Railroad Company to the Stockholders, together with the Report of the Chief Engineer to the Directors.

Communication of the Board of Directors.—Geo. M. Totten, Esq., the Chief Engineer of the Panama Railroad Company, has just submitted to the Board of Directors his annual report of the condition and prospects of this important work.

In presenting his report to the Stockholders of the Company, the Board deem it fitting that it should be accompanied by a brief statement of their views of the enterprise in which they are engaged.

Confident as they have ever been of the final accomplishment of the work, and at one period entertaining the hope of its completion during the present year, they have never realized so strongly as they now do, the certainty of the early consummation of their plans.

When the enterprise was commenced, the undertaking was as novel as it was formidable, and your Board enjoyed no advantage from the experience of others, no work of the kind having ever been performed under similar circumstances.

In a foreign country, where no road for wheel vehicles had ever existed, and possessing no supplies either of food or materials, it became necessary to send every thing from the United States, even laborers themselves to a great extent. Yet under these disadvantages, the road was so far finished in seventeen months, for a distance of twenty-three miles, as to admit of the passage of the cars, and over this portion of it daily trains have been run from that time to this.

At this point in the history of the road, your Board changed their mode of operations, and entered into an arrangement with other parties for the prosecution of the work, under the expectation that it would be pushed forward more vigorously, and be completed earlier, than by adhering to their previous plan.

They were disappointed in this expectation, and after the lapse of about fourteen months, during which time only eight miles more of the road were graded, in addition to the labor performed on the bridge crossing the Chagres River, they again took the work into their own hands, and are now carrying it on in the same general manner which was adopted at first, but with greater advantage, derived from their former experience, and from the increased facilities of obtaining native and other labor, and having the use of that portion of the road now in operation, for the conveyance of materials and men.

In view of the past history and present condition of their operations, in connexion with the character of the country over which the remaining eighteen miles of the road are to be constructed, and relying, as they do,

on the ability and intelligence of their Chief Engineer, the Board feel no hesitation in expressing to the Stockholders, their firm conviction that the work will be so far completed in all of the ensuing year, as to admit of the regular passage of the cars from ocean to ocean, and they entertain the hope that the time will not be prolonged beyond the month of August.

The Chief Engineer, in making his report, prepared some estimates of the income which may be anticipated from the business of the road on its completion, but inasmuch as they might be deemed extravagant by those not so familiar with the subject as himself, the Board have thought it best to omit them. Some idea may be formed, however, of the probable results, when it is considered how large the earnings have been on the section of the road now in operation, and how large a proportion of the expense of transporting passengers and merchandize across the Isthmus, is now received by the muleteers,* whose business will pass to the road, at once, when finished.

It should also be borne in mind, that the running expenses on a line like this, must necessarily bear a much less proportion to the receipts, than on any other road in the world.

That the business of the road will not remain stationary, but be greatly enlarged, admits of no question, and it will not be surprising should the views of the most sanguine in this respect be realized. A material increase may be looked for, on the opening of the line to the Obispo, at the close of the present year.

Already has the attention of capitalists in Great Britain and on the continent of Europe, been awakened to the importance of this route as a means of communication with the west coast of South America, the Sandwich Islands, China, Australia, and California. In addition to the Royal Mail Steamship line, now running between Southampton and Aspinwall, by way of the West Indies, three other lines have been organized to ply between Aspinwall and England. Besides, a French Company are engaged in building several steamers, under the auspices of the Government, to run to Aspinwall, and connect with other lines from Panama to Australia.

Add to these, the two American lines of first class steamers from New York, and one from New Orleans, and we have eight lines which will connect with the Atlantic terminus of our road when completed.

On the Pacific side, at least five lines will soon radiate from Panama, and probably others, with passengers and merchandise for California, Valparaiso, Australia, &c.

The Board might greatly enlarge, but it is not necessary. They entertain no apprehension of any want of employment for your road. On the

* The Railroad now receives less than one cent per pound for ordinary freight, and two cents per pound for express freight and extra luggage carried over the twenty-three miles, from Aspinwall to Barbacoas, while seventeen cents per pound are paid the muleteers from the latter point to Panama. On the opening of the road to the Obispo—eight miles further—the rates charged by the road will be considerably enhanced.

The rates for through freight, when the road shall be completed, has not been fixed, but the proportion will be materially increased, while the expense to shippers will be greatly diminished.

contrary, they are persuaded that, with a single track, its utmost capacity will be tested by the business which will be offered.

Should any of the Stockholders deem them visionary in their views, or too sanguine in their expectations, the Board beg leave to remind them that most of their number have been identified with the enterprise from the beginning, through good report and evil report, and have thus had superior opportunities for forming correct opinions; and although they would not conceal from themselves the fact that difficulties are yet to be encountered, they are willing to hazard their reputation as men of judgment on the success or failure of the enterprise they have undertaken.

The Board think the following information in relation to the real estate of the Company will be interesting to the Stockholders, most of whom, it is presumed, are not acquainted with the facts.

Under the original grant from the Government of New Grenada, for the exclusive privilege of constructing a railroad across the Isthmus of Panama, they ceded to the grantees about 300,000 acres of land, to be located along the line of the road, or at other points within the territory of the Government, as the grantees might select, together with the right to all the mineral wealth which the same might contain. In transferring their rights and privileges to the Panama Railroad Company, the grantors ceded to the Company one-half of the lands thus obtained.

By a subsequent arrangement with the Government, the Island of Manzanilla (Navy Bay) was received in exchange for a portion of the wild lands previously ceded, two acres of the latter being given for one of the former. The Island of Manzanilla, on which the city of Aspinwall is situated, comprises an area of about 650 acres.

The Island has been surveyed, and a portion of it laid off into blocks and lots, and prepared for the erection of buildings; of which over 300, of substantial character, have already been put up, by parties who have leased the ground, and which yield an annual income of about $15,000. A largely increased income from this source is anticipated at no distant day.

In addition to this, the Company possess one-half interest in three Islands in the Bay of Panama, which, it is believed, will ultimately be of great value.

They have also secured by purchase, at Panama, and grant from the Government, all the ground which may be required for depots, work-shops, &c., together with the right to reclaim and hold in perpetuity so much of the lands and flats lying below high water mark, as may be found necessary or desirable for their purposes.

It is difficult to estimate the importance of these possessions to the interests of the Company; in the judgment of many well informed parties, they will prove equal to the entire cost of the road.

The Board take much pleasure in stating that the Government of New Grenada, with a just appreciation of the importance of the undertaking, not only as bearing on the prosperity of their own country, but in its relations to the commerce of the world, have manifested every disposition to second the Board in their efforts to promote the objects they have in view; and in closing this communication, they would do injustice to

their feelings, were they not to express their grateful sense of the spirit of liberality and the courteous deportment, which have characterized the Government in all their intercourse with the officers of the Company.

WILLIAM H. ASPINWALL,	CORNELIUS W. LAWRENCE,
HENRY CHAUNCEY,	EDWIN BARTLETT,
G. B. LAMAR,	HENRY A. COIT,
EDWARD J. WOOLSEY,	GEORGE LAW,
JOSEPH B. VARNUM,	WILLIAM C. YOUNG,

DAVID HOADLEY.

The signatures of Gouverneur Kemble and Thomas W. Ludlow are omitted, in consequence of their absence in Europe.

New York, Nov., 1853.

—

Report of the Chief Engineer.—The period of the year having arrived when it is usual to prepare for the operations of the approaching dry season, I beg leave to present to your Board the following Report upon the condition and prospects of your road:

The whole length of the road from ocean to ocean, as finally located, is 49 miles, of which distance the portion from Aspinwall, the Atlantic terminus, to Barbacoas, where the line crosses the Chagres River, $23\frac{1}{4}$ miles, has been in operation the past sixteen months (since July, 1852).

Nine miles of this division were originally laid on piles and cribbing, which were the means adopted for crossing the low grounds and swamps, through which this part of the line passed; all of which, with the exception of about 1000 feet, is now filled in with earth. This track at present lies on firm embankments.

During the past year many of the original trestle structures for crossing the streams have been replaced by substantial culverts, or bridges, with masonry abutments, and iron superstructures, which style of work is being adopted throughout the whole line as rapidly as circumstances will admit.

During the past year, also, many portions of the track have been ballasted, and a large number of the original spruce and native soft wood cross ties, have been replaced with others, of lignum-vitæ, and other hard and durable woods, which will be continued throughout the whole road.

These improvements being completed, as they shortly will be, and your iron, which is of the bridge pattern, being of very superior quality, weighing 60 lbs. to the yard, it cannot fail to be seen that you will soon have as perfect a road as can be found in the United States, as it is already of fair average character.

The erection of the bridge over the Chagres River has been impeded by various causes, among which may be mentioned, an untimely flood in Ap[illegible] last, which carried away the main span, when nearly completed. Th[illegible] span is now securely placed, and the whole bridge will probably be completed by Dec. 1st. The substantial stone piers and abutments a[illegible] already finished.

From Chagres River to Obispo, $7\frac{4}{5}$ miles, the grading is nearly finished, and three miles of track are laid.

By Dec. 1st, or as soon as the bridge is completed, the road will be open for the trains to Gorgona, $5\frac{1}{2}$ miles from Barbacoas, the present terminus; and by Jan. 1st, to the Obispo, $7\frac{4}{5}$ miles, or in all, 31 miles from Aspinwall, the Atlantic terminus.

Within the past few months the mule road from Cruces to Panama has been under repair, and it is now in a very passable condition. It is still in the course of improvement by a force of 150 laborers, which will be maintained upon it during the present wet season.

A branch road is under construction from the line of the railroad, near the Obispo, to the Cruces road, by which means, when the trains reach this point, the passengers and freight will be transferred directly from the cars to the mules; the river route, which is now so tedious and disagreeable, will be avoided; and the transit will be readily made from ocean to ocean, in twelve hours.

Noting now, that the grading of the remaining portion of the road is commenced along the Obispo, as well as at Panama, the Pacific terminus, and that eight miles of this distance is already cleared of the timber, and prepared for working operations, we have the true state of the work at the present time.

Recapitulating, then, the substance of the foregoing, it appears, that out of the 49 miles, which will be the whole length of the road from ocean to ocean, $23\frac{1}{4}$ miles are already in operation, and in good condition, and that by the 1st of January, 1854, $7\frac{4}{5}$ miles more, making 31 miles, will be in operation, leaving 18 miles to be constructed, and that these 18 miles are already commenced at both ends, upon which large forces are fast accumulating.

I now come to the plan of operations for the future, or rather, for the approaching dry season, and the prospect before us, the scene of which will be the division of 18 miles above mentioned, extending from the lower crossing of the river Obispo (the line crosses this river twice in the space of one mile) to the Pacific terminus of the road at Panama, upon which division, as I have just stated, the work is already commenced, both along the valley of the Obispo, and at Panama.

In this distance we cross the summit ridge, the maximum grade on the Atlantic slope being 61 feet per mile, and on the Pacific slope, 70 feet per mile, and the total rise 250 feet above high tide of the Pacific.

In any other country, the ground over which this line passes would be considered favorable. The heaviest work is at the summit, where a cutting is encountered 1300 feet in length, and 24 feet in greatest depth, containing 30,000 yards of favorable excavation.

The time requisite for constructing this division must, of course, depend upon the amount of labor which can be thrown upon it.

Supposing that the work is of the same average character as the eight miles below, constructed by Mr. Story, which it is, both in regard to the amount of work, or number of yards per mile, and character of soil, and king the fact that these eight miles were graded in about ten months, th an average force not exceeding 900 men, the 18 miles now to be

constructed can be graded in six months, with a force of say 3370 men.

Temporary bridge and track will require	300
Masons and Quarrymen, . .	200
Repairs and completion of road, below Barbacoas,	500
" " " " above "	200
Total force required, .	4570

say 5000 men to complete the road in six months.

It would, perhaps, be thought more appropriate by some persons, to estimate the number of men required to do this work, by the number of yards contained in it, and the number of yards considered as a fair day's work per man (which has been done, and found to substantiate the above), but on the Isthmus, where a day's work is a very uncertain quantity, it is more satisfactory to estimate from what has been done under similar circumstances, and, estimating in this way, it appears that the road can be completed from ocean to ocean, by August 1st, 1854, by the number of men mentioned above.

The question now comes, appropriately: Can this number of men be obtained?

In answer to which, I would make the following statement:—

The force on the road now is,

Native laborers, Jamaica men and Coolies, .	1200
White men, . . .	390
Total,	1590
Arrangements which can be depended upon are made for bringing to the work from the Province of Carthagena, and adjacent country, by January next, New Grenadian natives, . .	2000
Further arrangements are made for bringing from other parts of that Republic 1000 men, from which may fairly be expected,	500
Your Board has ordered from China (Coolies)	1700
And from Ireland,	1000
Total	6790

In addition to which, you are forwarding to the work from this country about 150 laborers and mechanics monthly.

As to the character of the laborers above enumerated, it may be well to say a few words.

Irish laborers are not so efficient on the Isthmus as in cooler and healthier climates; yet, for a period of from four to six months, which is the term of their engagement, they perform a fair amount of work.

The Coolies are at first feeble and inefficient, but being steady workmen, temperate, and but little affected by the climate, as they become accustomed to the use of the tools, and acquire strength from regular and wholesome food, they make useful workmen.

The natives from the province of Carthagena are as accustomed to the pick, shovel, and wheelbarrow, as are Irishmen. For the past nine years, this portion of the laboring population of New Grenada has been under my employment. Many of them have grown up from boys to the use of these implements. They are an elastic, hardy race, and in all respects

the most efficient common laborers that can be employed on your work. They are, also, excepting the Coolies, the most economical.

An exact estimate of the cost of work on the Isthmus, even after the years of experience I have had in that country, I should not pretend to make. The reason for which is obvious. The line of the railroad affords nothing which can be used in its construction. All materials are imported there. Even the timber for the cross ties is carried there from this country, or from distant parts of New Grenada. The workmen, whether native or foreign, are conveyed there for the express purpose of that work, at a cost of from fifteen to fifty dollars each. Sickness, although bearing no comparison to the exaggerated reports which have been circulated in regard to that work—not even amounting to the average sickness on the public works in many of our Western States—is a serious item of expenditure. The following estimate, however, I consider sufficient to cover the cost of reaching the Pacific in the mode contemplated, the items of which are derived from the profile of the line as located, and the prices are such as have been found sufficient on the work already done on your road.

571,000 cubic yards of Excavation and Embankment, at $1·40,	$799,400
28,000 do do Rock, $4·00,	112,000
18 Miles of Track, including cross ties, $7300 per mile,	131,400
Temporary Bridges, . . .	94,000
Grubbing and Clearing, . . .	10,000
Cost of completing the 18 miles now under construction,	$1,146,800
To which add cost of repairs, and expenditure on construction of unfinished work between Aspinwall and the Obispo,	280,000
Total expenditure required to reach the Pacific terminus,	$1,426,800

The iron for the whole road is on the ground, having been purchased at an early period of the work, and therefore does not enter into an estimate of expenditure yet to be made.

G. M. Totten, *Chief Engineer.*

New York, Nov., 1853.

---

*Statistics of Railway Rolling Stock in Great Britain.**

It appears from a return that the total number of locomotive engines on railways in the United Kingdom is 3942, being about one locomotive to every two miles of railway; the number of first class carriages 2413, capable of holding 49,226 passengers; the number of second class carriages 3413, capable of holding 124,703 persons; the number of third class carriages 2954, capable of holding 121,807 persons; the number of composite carriages 1114, capable of holding 35,239 persons; and the number of other carriages 1470, capable of holding 4231 persons—making together 11,364 carriages, capable of holding 335,206 passengers. The number of horse boxes is 1547, capable of holding 4547 horses; the number of cattle wagons, 7127, capable of holding 76,696 head of cattle. The number of carriage trucks is 1561.

* From Herapath's Journal, No. 750.

Of the 3942 locomotive engines, 3221 are used on railways in England and Wales, 527 on railways in Scotland, and 194 on railways in Ireland. Of the 2413 first class carriages, 1967, capable of holding 40,005 persons, are on railways in England and Wales; 346, capable of holding 6252 persons, on railways in Scotland; and 100, capable of holding 2969 persons, on railways in Ireland. Of the 3413 second class carriages, 2846, capable of holding 104,811, persons are on railways in England and Wales; 396, capable of holding 10,930 persons, on railways in Scotland; and 171, capable of holding 8962 persons, on railways in Ireland. Of the 2954 third class carriages, 2204, capable of holding 93,235 persons, are on railways in England and Wales; 545, capable of holding 17,743 persons, on railways in Scotland; and 210, capable of holding 10,829 persons, on railways in Ireland. Of the 1114 composite carriages, 822, capable of holding 26,635 persons, are on railways in England and Wales; 210, capable of holding 4846 persons, on railways in Scotland; and 82, capable of holding 3758 persons, on railways in Ireland. Of the 1470 other carriages, 1305, capable of holding 2961 persons, are on railways in England and Wales; 101, capable of holding 820 persons, on railways in Scotland; and 64, capable of holding 450 persons, on railways in Ireland. Of the 1547 horse boxes, 1282 capable of holding 3751 horses, are on railways in England and Wales, 162, capable of holding 486 horses, on railways in Scotland; and 103, capable of holding 310 horses, on railways in Ireland. Of the 7127 cattle wagons, 5892, capable of holding 67,319 head of cattle, are on railways in England and Wales; 745, capable of holding 5423 cattle, on railways in Scotland; and 490, capable of holding 3954 cattle, on railways in Ireland. The number of carriage trucks on railways in England and Wales is 1311, in Scotland 165, and in Ireland 85.

On the broad, or 7 feet gauge lines, the working stock consists of 239 locomotive engines, 197 first class carriages, capable of accommodating 5880 persons; 259 second class carriages, capable of holding 17,150 persons; 71 third class, capable of holding 4632 persons, and 44 composite carriages, capable of holding 2029 persons; 168 horse boxes, capable of holding 647 horses; 1492 cattle wagons, capable of holding 11,699 cattle; 230 carriage trucks, and 103 vans.

On the narrow, or 4 feet 8½ inch gauge lines, in England and Wales, the working stock consists of 2982 locomotive engines, 1770 first class carriages, capable of holding 34,125 persons; 2578 second class carriages, capable of holding 87,661 persons; 2133 third class carriages, capable of holding 88,603 persons; 778 composite, capable of holding 24,606 persons; 1202 other carriages, capable of holding 2961 persons; 1114 horse boxes, capable of holding 3104 horses; 4440 cattle wagons, capable of holding 55,620 head of cattle, and 1081 carriage trucks. They are all narrow gauge lines of 4 feet 8½ inches in Scotland; the gauge of railways in Ireland is 5 feet 3 inches. The working stock on these lines is stated above.

For the Journal of the Franklin Institute.

Quantity of Coal Shipped at the Port of Pictou, in British and American Ships, to the United States, to August 25, 1853.

Communicated by W. H. Shock, Esq., Chief Engineer U. S. Navy.

Years.	British Ships. Tons.	American Ships. Tons.	To Brazils in American Ships. Tons.
1846	28,000	30,303	
1847	49,135	41,343	
1848	43,225	33,333	240
1849	43,350	25,335	
1850	49,450	21,903	
1851	35,174	8,558	
1852	55,277	18,525	1070
1853 to date	35,000	9,000	
Total.	333,611	188,280	1310

*Experiments in Stopping Trains.**

Some experiments were made on the Great Southern and Western railway during the inquest to try the effect of the brakes in stopping the trains.

The first experiment was with an engine 22 tons, tender 10 tons, 17 wagons loaded, and 3 carriages, weighing together 145 tons $12\frac{1}{2}$ cwt., and the speed above 20 miles an hour. Owing to not having heard the whistle, the guard of the brake van did not apply his brake until some little time after the fireman had applied his to the tender. As it was, the train stopped in $1\frac{1}{2}$ minute, and in 915 yards, or 35 yards above a half mile.

In a second experiment, with a speed under 25 miles an hour, the brakes being well and simultaneously applied, the train was brought up at 637 yards.

A third trial gave 804 yards, with a speed of better than 32 miles an hour.

Nothing is here said of the gradient of the line, nor which way it inclines, which are very material points in the question.

AMERICAN PATENTS.

List of American Patents which issued from November 15, to December 6, 1853, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

NOVEMBER 15.

49. For an *Improvement in Looms for Weaving Pile Fabrics;* Erastus E. Bigelow, Boston, Massachusetts.

Claim.—"What I claim is, 1st, The method of constructing and operating the pincers,

* From Herapath's Journal, No. 750.

or other equivalents, for successively operating the pile wires, so that they shall carry said pile wires forward to the face of the cloth, and hold them in position with their proper edges upwards, until they are otherwise secured, substantially as specified. I also claim constructing the pincers for successively operating the pile wires with grooved jaws opening and closing in a line with the pile wire, and with a motion in advance of the lathe, substantially as specified, whereby collision with the lathe is easily avoided. I also claim the application of long horizontal guides, substantially in the manner and for the purpose specified. I also claim the application of a vibrating box or holder, in combination with the pincers, or their equivalents, for successively operating the pile wires, substantially in the manner and for the purpose specified. I also claim, in combination with the pile wires, a bar or guide, which shall successively press against said pile wires, to keep them in a proper position during the operation of cutting, substantially as specified. And, finally, I claim the method of applying the tension weight and brake to the whip roller by means of the arms, substantially in the manner and for the purpose specified."

50. For an *Improvement in Power Looms;* John Gledhill, City of New York.

Claim.—"What I claim is, 1st, The combination of the main connecting rods, links, and radius rods, substantially as described, for giving the lay a motion, the forward part of which is accelerated, and the backward part is retarded, for the purpose set forth. 2d, The 'automatic server,' consisting of a block or head furnished with any number of hooks, or analogous devices, arranged in any number of series, according to the number of bunches of filling hair or threads, and in order of succession; the said block or head being hung, substantially as described, on a pivot, in such a position that when a proper amount of circular motion is given to it by suitable mechanism, the hooks will withdraw the hairs from one or other of the bunches, and bring them to a suitable position to be taken by the nippers, or other device, which draws them through the warp. 3d, A pair of nippers, which are operated by suitable mechanism, substantially as described, to make their jaws pass through the warp from one side thereof every time the shed is opened, seize one or more hairs or threads from the opposite side, and return through the open shed with the same, and release the same when it is beaten up and the shed is closed. 4th, The combination of the fixed stud, finger, lever, spring, and arm, substantially as described, the stud, finger, and spring being for the purpose of producing a proper tension on the hairs or threads as they are being drawn through the shed, and the lever and arm being for the purpose of moving the finger to allow the nippers to pass in coming to fetch the hairs or threads."

51. For *Supplemental Valve to the Equilibrium Pipe of the Cornish Engine;* Henry P. M. Birkinbine, Philadelphia, Pennsylvania.

Claim.—"I wish it to be understood that I do not confine myself to the particular form of supplemental valve described, or to the particular method shown of actuating the same; it will be easily seen that a slide valve might answer the same purpose as the former, and that various mechanical devices might be substituted in place of the latter; but what I claim is, the use of the adjustable valve apparatus described, or any equivalent to the same, for intercepting, more or less, the steam in the equilibrium passage, so as to regulate the rapidity of descent of the plunger, according as the head of water may require."

52. For an *Improvement in Daguerreotype Apparatus;* James Brown, City of N. Y.

"The nature of this invention consists in the employment of an ornamental diaphragm, with a suitable opening placed in a suitable position in front of the person or subject to be represented, for the purpose of producing a portrait or picture, with an appropriate or tasteful ornamental border, either with or without the name of the person or subject, and the name of the artist. The diaphragm may be, and will be mostly, used in conjunction with a back ground, such as is now sometimes used, illustrative of the character of the person or subject represented."

Claim.—"What I claim is, the employment of a diaphragm with a suitable opening, through which the person or subject is presented to the camera, when the said opening is surrounded by ornament or embellishment, substantially as described, for the purpose of producing a portrait or picture with an ornamental or embellished border."

53. For an *Improvement in Electro-Magnetic Annunciators;* Charles S. Bulkley, City of New York.

Claim.—"What I claim is, the circuit closer, constructed in such a manner, in combination with the permanent arrangement of the several numeral characters and words or

sentences necessary to designate the number of each room, and the ordinary desires of the lodgers, upon concealed register plates, which are connected with and operated by electro-magnets, through suitable escapement, or other equivalent devices; that, by a single sweep of the key to the point denoting the particular communication the lodger wishes to make, the circuits of the said magnets will be closed and broken the required number of times to strike the bell, and exhibit, through apertures in the face of the register, that number and word or sentence of the said register plates which respectively designate the number of the lodger's room, and the communication made by him, substantially as set forth."

54. For a *Machine for Dressing Staves;* Joseph D. Elliot, Leicester, Massachusetts.

"The nature of my invention relates more particularly to the use of a transversely inclined bed, upon which the staves are fed into the cutters, so as to adapt the machine to the dressing of thick or thin, tapering or wedge shaped riven staves, with the grain of the wood, without separately adjusting the machine, or assorting the staves."

Claim.—"What I claim is, the combination of the transversely inclined bed with the swiveled roller, for the purpose of adapting the machine to the dressing of riven staves with the grain of the wood, whether thick or thin, tapering, or inclined from edge to edge, without any separate adjustment for the various sizes, substantially as described."

55. For an *Improved Chuck for Cutting Barrel Heads;* Franklin Fruit, Jefferson City, Missouri.

"The nature of my invention consists in holding the material of which the barrel head is cut by means of a chuck, having a series of centres, placed in circular form, and concentric with the periphery of the chuck. Each centre is provided with a spiral spring, which enables the centres, individually, to give or yield, so that the different pieces forming the barrel head may vary in the thickness, and still be firmly held by the chuck, as will be presently shown."

Claim.—"What I claim is, the chuck, constructed substantially as shown and described, viz: two circular disks, connected by studs and centres, placed between the studs, any proper number of studs and centres being used, said centres passing through both the front and back disks, and having collars upon them, each centre being provided with a spiral spring, which is placed between the collar and the inner side of the back disk, and by which springs each centre will yield or give, independently of the others, so that the different pieces forming the barrel head may vary in thickness, and still be properly adjusted and secured between the face plate and chuck, as set forth."

56. For *Improvements in Propellers;* Banford Gilbert, Pittsburg, Pennsylvania.

Claim.—"I do not desire to claim the use of submerged propellers, actuated by a reciprocating motion, nor the use of propellers with two levers or floats, hinged at or near their point of connexion, and operating by opening and closing as they pass to and fro through the water, as in the case of the duck's foot propeller; but what I do claim is, the combination of the anchors with the double floats or paddles, suspended so as to hang vertically in the water when in use, and operating with a horizontal reciprocating motion, one of the floats in each set propelling the boat in one direction, and the other float in each set propelling it in the opposite direction. One anchor being combined with each set of double floats for the purpose of retaining one float in a horizontal position, so as to pass through the water with the least possible resistance, when not in use, and sustaining the pressure of the water against the paddle in use, when in the vertical position, which the anchor compels it to retain while propelling the boat, and leaving it free to assume the angle of least resistance while returning through the water. The simultaneous reversing of the double paddles being accomplished by means of a handle which shifts the connecting rod, to which all the anchors in one frame are attached, in the manner described."

57. For a *Machine for Dressing Circular Sash, &c.;* Leonardo Gilson, Brighton, Mass.

Claim.—"What I claim is, 1st, The swing bed frame and adjustable bed plate, in combination with the lever, clamps, and set screws, substantially in the manner and for the purpose set forth. 2d, I claim an angle frame with a joint at or near the vertex, to increase or diminish the angle with a movable segment plate thereon, in combination with the bed plate and cutters for circular work, as described."

58. For an *Improvement in Machines for Creasing Straps of Leather;* Daniel H. Hovey, Kilborn, Ohio.

Claim.—"What I claim is, the combination of the self-adjusting creasers, springs, vibrating cam, and pressure roller, arranged and operating substantially in the manner and

for the purpose set forth. The above specification of my improved machine for creasing straps and other forms of leather for harness and other purposes, signed by me this third day of March, 1853."

59. For *Improvements in Ventilators;* Joseph Leeds, Philadelphia, Pennsylvania.

"The nature of my invention consists in arranging a series of downwardly inclined curved openings in the outer case or shell of the ventilator, for taking in and directing downward into the building to be ventilated, a current or currents of pure air, and in connecting therewith a passage in the centre of the ventilator, through which the impure air may be drawn upward by an accumulated or increased draft over the top of said passage; also, in the manner of increasing the draft across the top of the ventilator to aid the upward current of air through the centre passage."

Claim.—"What I claim is, the combination, in one case or shell, of the series of downwardly inclined curved openings in the outer shell, for taking in and directing downward a column of pure air, with the centre pipe or opening crowned with the two frustrums of cones, with their apices towards each other, for producing a counter current, and carrying from the apartments to be ventilated the impure air, and increasing said ejecting current, substantially as described, the whole requiring but a single opening in the roof."

60. For an *Improved Coating Box for Daguerreotype Plates;* Wm. Lewis and Wm. H. Lewis, City of New York.

Claim.—"What we claim is, 1st, The metallic base, formed as a box, to which either cold water or heat are to be applied to regulate the temperature of the chemicals in the coating box, as described. 2d, Suspending the glass pot within the coating box by means of a flanch or bead on the upper edge thereof, taking the upper surface of the box, as specified. 3d, We claim the rollers, in combination with the ways, formed with the inclines to relieve the friction, as specified. 4th, We claim the rollers on the cover, combined with the ways and inclines on the slide, to lift the cover and relieve friction, as specified. 5th, We claim the rebates, to support the glass on the lower surface thereof, in combination with the screws, to retain the same against the rebates, as specified. 6th, We claim securing the metal yoke in place by ribs on the inner sides of the vertical parts thereof and the slides, as described. 7th, We claim the hub on the yoke, taking the socket in the cover, and containing the spring, whereby the cover is retained in place, but allowed to take its proper bearing, as described."

61. For an *Improvement in Self-Acting Dampers for Air Tight Stoves;* Sergius P. Lyon, Farmington, Michigan.

Claim.—"What I claim is, the arrangement of the lever, having the valve on its lower end, and a curved portion and flat spring on its upper end, in combination with the lever pivoted between the curve portion and spring, (said lever attached to the upper valve,) the thumb screw, and expansible plate; the whole operating automatically in the regulation of the draft of air to the fire, and also to the induction of air to the flue, in the manner set forth."

62. For an *Improved Paddle Wheel;* William Henry Muntz, Norton, Massachusetts.

Claim.—"The mode of making the paddle wheel is claimed by me, such mode consisting, 1st, In making the supports of the buckets, a cut-water wheel, and two wheels of smaller diameter. 2d, Of forming each bucket of a float and guard made to stand at an angle to each other. 3d, Of making the guard to extend from the rim of the cut-water wheel to the other or smaller wheel, and so that the guard shall not only pass edgewise through the water, but endwise into the water, the float being made to project inwards from the guard, as stated. And, in combination therewith, I claim making the float narrowest at its outer end, or at the cut-water wheel, and gradually increasing in width towards its inner end, as described."

63. For an *Improvement in Seed Planting Cultivators;* George Phillips, Philadelphia, Pennsylvania.

"The nature of my invention and improvements consists in so constructing, combining, and adapting the several parts of the planter, harrow, and cultivator plough, as to enable them to be separated or attached at the will of the operator, and to perform either of the functions for which they are designed in a more effective manner than heretofore; and also, in attaching to the upright post, at the back part of the centre or draft beam, a gra-

duating and driving wheel, capable of being either used for those purposes, or as a pivot wheel to turn the machine on when it is desired to do so for any purpose."

Claim.—"What I claim is, the arrangement and combination of the side pieces, slotted beam, and slotted bars, and the hollow sectional axle or shaft, for the purpose of allowing the expansion and contraction of the side pieces, in the manner and for the purpose set forth. I also claim attaching the driving and graduating wheel to the back part of the machine by means of the notched bars, secured to the upright post of the centre or draft beam by a bolt upon which they move, and suspending above the same pawls, which enter the notches, thus enabling said wheel to perform its functions of regulating the height of the back part of the machine and driving the distributing shafts, and to be drawn or thrown under the centre or draft beam to form a pivot wheel, upon which the machine can be raised from the ground and turned, in the manner and for the purpose specified."

64. For an *Improvement in Mop Heads;* Timothy Randlett, Enfield, New Hampshire.

Claim.—"What I claim is, the binder and revolving tightener, combined with and embracing the united cross-head, the socket, and ridge, substantially in the manner and for the purpose set forth."

65. For an *Improvement in Feed Rollers of Straw Cutters;* Robert Sinclair, Jr., and Richard F. Maynard, Baltimore, Maryland.

Claim.—"What we claim is, the employment of alternate right and left fins, so arranged as to form a double spiral or screw, said fins being formed substantially as set forth, and operating together, so as to prevent the straw from crowding to the right or left, and to compress the straw laterally as it is passed to the knives, and constituting altogether what we denominate the double screw propeller for straw cutters."

66. For an *Improved Machine for Trimming Soles of Boots and Shoes;* John H. Thompson, James M. Thompson, and Hosea Q. Thompson, Holderness, N. H.

Claim.—"What we claim is, a machine in which the sole is 'trimmed' by revolving knives, and guided, as fed along by the operator, by an adjustable gauge bar, against which the edge of the pattern plate abuts, substantially as described."

67. For *Hot Air Registers;* William H. Towers, Philadelphia, Pa.

Claim.—"What I claim is, the placing within the jambs of each register, the means of moistening the heated air, as described."

68. For an *Improvement in Looms;* William Townshend, Hinsdale, Mass.

Claim.—"I do not claim the levers in themselves, as these have before been used; neither do I limit myself to the number of heddles and treadles; and I do not claim the pattern chain in itself, as this is well known: but what I claim is, the levers on a slotted fulcrum, with their latch pieces, or their equivalents, combined with the levers, by which arrangement the levers are connected to either lever by means of the end motion, and carried up and down by competent power applied to the levers."

69. For a *Machine for Finishing the Ends of Staves;* J. E. Warner, Boston, Mass.

"The nature of my invention consists, 1st, In the use of circular saws to cut the staves to equal lengths. 2d, In the use of revolving cutter-heads, having in each three sets of movable and adjustable cutters; the first set for forming the bevel on the ends of the staves; the second set for equaling the thickness of the staves at each end; and the third set for cutting the grooves for the heads. 3d, In the use of a rotary bed, which, slowly revolving on its axis, carries the staves to the saws and cutters, and deposits them when finished on the opposite side of the machine. This bed is made to yield to the varying thickness of the staves, and by means of weights, the staves, while being wrought, are kept steadily in contact with fixed stops."

Claim.—"I do not claim a feed bed revolving in fixed bearings as any novelty; but what I claim is, a feed bed revolving in bearings which are capable of being moved by weights, springs, or other means, towards the beds or stops on which the back or outer side of the stave is supported, the extent of such movement depending upon the thickness of the staves operated on. I also claim the combination of said feed bed with the saws, cutters, fixed stops, and movable frame, and what are substantially their equivalents, operating in the manner described, for the purpose of finishing the ends of staves."

70. For an *Improvement in Safety Valves for Locomotive Engines;* Henry Waterman, Hudson, New York.

Claim.—"What I claim is, the piston attached to the weighted end of the valve

lever within the cylinder, and immersed in the liquid in the cylinder, combined and operating in the manner and for the purposes described."

71. For an *Improvement in Uniting Shovel Blades to Handle Straps;* Jonathan White, Antrim, N. H.

Claim.—"I claim the uniting by welding of the iron handle straps to the sheet cast steel blade in the manner substantially as set forth."

72. For an *Improvement in Rotary Churns;* Hosea H. Grover, North Cohocton, N. Y.

Claim.—"I do not claim a churn tub in the form of an inverted cone or conic frustrum with revolving dasher, either with or without breakers, as such churns with breakers and dashers extending from the bottom to the top of the tub, or with dashers without breakers, have been used before: but what I do claim is, a churn, consisting of such conical tub, furnished with a vertical revolving dasher at its bottom, combined with breakers at the top, in the manner and for the purpose set forth."

73. For a *Machine for Dressing Crooked Timber;* Evan H. Branson, assignor to Franklin Slaughter, Fredericksburg, Va.

"The nature of my invention consists in supporting the arbor of one of two pulleys, carrying an endless belt of knives upon elastic bearings, arranged and operated as set forth."

Claim.—"What I claim is, supporting the arbor of one of two pulleys, carrying an endless belt of knives, for dressing crooked timber upon elastic bearings, for the purpose of yielding to any undue strain upon the knives, substantially as described."

NOVEMBER 22.

74. For *Improvements in Joining and Riveting Metallic Plates;* William Beschke, Alexandria, Virginia.

"The nature of my invention consists in joining and riveting plates together in such a manner as to give the greatest strength to the whole."

Claim.—"What I claim is, the method of equally dividing the weakness resulting from the joining of iron, steel, or any other metallic plates, and is effected by putting said plates together so as to break joint at the ends, and riveting over these another similar set of plates so as to break joint at the sides and ends with the first, thus entirely covering joints of the first, the rivets over the surface being equi-distant from each other, and from those confining the edges."

75. For an *Improvement in Body Braces;* Gardner S. Browne, M. D., Hartford, Conn.

Claim.—"What I claim is, uniting the shoulder and abdominal brace by pliable springs, so arranged and constructed that they shall be confined on each side of the spine to the abdominal brace, and when fastened at one end permit a limited vibration, and when fastened to the other end be rigid, in the manner described; whereby the same brace can be adapted to a variety of patients in different stages of disease, or to different stages of disease in the same patient."

76. For an *Improvement in Nut Machines;* Henry Carter and James Rees, Pittsburg, Pennsylvania; ante-dated June 3, 1853.

Claim.—"What we claim is, the arrangement of the devices substantially as described, for reducing the end of the blank bar to a given thickness preparatory to serving the blank, whereby nuts of uniform thickness are produced from bars of irregular thickness, and the machine is protected against injurious strains."

77. For an *Improvement in Transporting Bridges;* Thomas Champion and Samuel Champion, Washington, District of Columbia; ante-dated May 22, 1853.

Claim.—"We claim the improved method of operation described, viz: building bridges on shore on a level, or thereabouts, with their resting places on the abutments, and then setting them in place by moving them into position, substantially as set forth."

78. For an *Improvement in Ventilating Railroad Cars;* Stillman A Clemens, Springfield, Massachusetts.

Claim.—"I do not claim the conveying planes for gathering and condensing a current of air; nor do I claim a mode of filtering air by causing it to pass through a porous or

fibrous substance or material which is in a dry state, or unprovided with arrangements for securing a continual supply of moisture to replace that which is evaporated by the air passing through it; nor do I claim the arrangement for blowing the sparks outwards through a narrow opening in the back of the ventilator; what I claim is the mode of ventilating railroad cars, etc., by causing the air to pass through sponge, or other suitable, or porous or fibrous substance or material; said material being provided with means for a continual supply of water to moisten it, and replace that which is evaporated by the air which passes through it, substantially as set forth, and for the purpose specified."

79. For an *Improvement in Looms;* Oliver A Kelley, Woonsocket, Rhode Island.

Claim.—"What I claim is, 1st, The arrangement of levers, as described, connected by a spring or elastic connecting rod, in combination with the tappet wheel, whereby the shuttle boxes are raised and lowered by a yielding mechanism, which diminishes greatly the liability to breakage, as specified. 2d, The method of balancing the shuttle boxes on the lay, in combination with mechanism for simultaneously raising one set and depressing the other, substantially as specified. 3d, The reciprocating and rotating pattern cylinder, in combination with the vibrating lever or the equivalent thereof, for the purpose of rendering the intervals between the changes of the shuttles, regular or irregular, substantially as set forth. 4th, The rack cylinder, or the equivalent thereof, in combination with the two pinions and the mechanism for throwing them alternately into or out of gear, or the equivalent thereof, whereby the racks are moved in alternately opposite directions, with a variable range of motion as required for operating the pattern cylinder. 5th, A series of pins, or the equivalent thereof, on the inner end of the rows of holes in the pattern cylinder, a disk having a corresponding number of pins or teeth on its periphery placed loosely on the axis of the rack cylinder, and the pawls which turn the disk and pins, in combination with the rack cylinder, whereby the latter is turned at each extreme of its vibration, so as to throw one pinion out of gear with the racks, and the other in, to reverse the motion. 6th, The method of uniting the pattern cylinder, or its equivalent, with the rack cylinder, or its equivalent, by a yielding or slip coupling, operating substantially as specified, whereby the danger of breaking the mechanism when it happens to become deranged is greatly lessened. 7th, The method of working the same row of holes in the pattern cylinder to the right and left in succession, in case the cylinder should not have holes enough to work the ornamental design in the cloth by working the holes once only, whereby a cylinder of a given size will be capable of producing a much more elaborate design, or larger figure, than if the holes could be used but once in the production of the same figure."

80. For an *Improved Water Wheel;* Frederick Smith, Pontiac, New York.

Claim.—"What I claim is, the ventilating water wheels inclosed by a curb, scroll, or box, by means of a tube communicating with the wheel, or in any other manner substantially the same, in combination with the buckets, and constructed and arranged in the manner and for the purpose set forth."

81. For *Apparatus for Cutting Screws on Bedstead Rails;* James R. Kain, Tiffin City, Ohio.

Claim.—"What I claim is, the combination of the spiral faced plates, with the arms and spring for securing the rail in the machine, as specified. I further claim the catch, in combination with the notched tie and pins, substantially as specified, for carrying the right and left nuts against the screw and securing them in position, as set forth."

82. For an *Improvement in Boxes for Supplying Business Cards;* Wm. Lewis and William H. Lewis, City of New York.

Claim.—"We are aware that various apparatus has been used for supplying cards to be printed, but we are not aware of the slide, lip, and gate, having been used for the purpose, and as specified; therefore, we claim the lip on the slide, combined with the gate, to draw out one card at a time, as specified."

83. For an *Improvement in Platform Scales;* Samuel T. McDougall, City of N. York.

Claim.—"What I claim is, the arrangement of the triangular lever and the two independent side levers, having their long arms suspended from knife edges attached to said lever, whereby the final adjustment necessary to make the scale give the same weight on all parts of the platform may be made by moving the bar only, which carries the two last

named knife edges, without the necessity of any precise adjustment of the two knife edges upon the levers, to equal distances from the fulcra of those two levers."

84. For a *Machine for Cutting Screws on Bedstead Rails, &c.;* J. Parsons Owen, Norwalk, Ohio.

Claim.—"I claim nothing in the construction of the mandrels and cutters; but what I do claim is, supporting the mandrels in the oscillatory frame, as described, which, in combination with the lever and wedge, permits either mandrel to be brought effectually into operation for cutting, substantially as set forth. I also claim the eccentric grooves of the cams, in combination with the bars, substantially as and for the purposes set forth."

85. For an *Improvement in the Cutters of Grain and Grass Harvesters;* Wm. Pierpont, Salem, New Jersey.

Claim.—"What I claim is, hanging the cutter blade at each end to a crank, so as to cause the rotary draw cut in form of a circle, substantially as described, in combination with the counter rod, for insuring the perfect revolution of both shafts in unison."

86. For an *Improvement in Revolving Fire Arms;* Morgan L. Rood, Marshall, Mich.

Claim.—"I do not claim the revolving cylinder, nor do I claim the crank, rock shaft, tightening cam, tumbler, stirrup, revolving lever, or spiral spring, nor the ratchet teeth, nor the circular groove on the end of the cylinder, nor the adjusting spring, or the guard, or their equivalents, they having been before used; nor do I claim a slotted arm as merely connecting the hammer with the crank; nor do I claim the smoke guard; but what I do claim is, the peculiar arrangement in fire arms, described above, by which the guide pin, in combination with the stop notches, adjusting spring, and the hook connexion between the smoke guard and rock shaft, causes a more perfect joint, and more secure connexion between the cylinder and barrel, thus preventing all leakage, keeping the cylinder and its attachments clean, and protecting the surrounding charges from taking fire. I also claim the arrangement of the slotted arm and the hammer, by means of which the gun may be cocked, with or without moving the cylinder."

87. For an *Improvement in Blasting Powder;* William Silver, Jr., Pittston, Pa.

Claim.—"What I claim is, the blasting powder, as set forth, the same consisting in an unglazed powder composed of charcoal, nitre, and sulphur, in the proportions specified, prepared and treated with chlorate of potash, according to the directions, substantially as set forth. I do not claim the use of chlorate of potash as a means of preventing smoke in mine blasting, except when combined with charcoal, sulphur, and nitre, in the manner substantially as set forth."

88. For *Apparatus for Cutting Screws on Bedstead Rails, &c.;* Hiram Smith, Norwalk, Ohio.

Claim.—"What I claim is, 1st, The formation of the cutters, as described, in sections of the cutter heads, which are secured by means of screw bolts, substantially as set forth. 2d, Securing the section of cutter head containing the post cutter by means of a polygonal headed bolt, passing, as described, through the hollow spindle, cutter head, and section base, which arrangement, in addition to securely holding the cutter, admits of the adjustment of the cutter, as described, for insuring the formation of tight joints between the post and rail. 3d, The method described, of attaching the tenon socket to the spindle. 4th, The arrangement of the standards and clamp upon the blocks, by which the machine is secured to the post and rails, and the operation of cutting facilitated, as set forth."

89. For an *Improvement in Facing Ends of Percussion Caps;* Dr. James Goldmark, City of New York.

"The nature of my invention consists in inserting a series of percussion caps in appropriate holes made in a plate fitted to or making part of a stock, to be used in combination with the surface of a grinding wheel, or other reducing surface, so that when so inserted in the holes of the plate with the open end outwards, or towards the grinding or reducing surface, and moved over or caused to slide in a plane parallel with the grinding or reducing surface, or vice versa, and the said grinding or reducing surface set in motion, all the caps will be reduced to an equal depth, and the edges reduced to the same level."

Claim.—"I claim, in combination with the holding plate, substantially as specified, the employment of the guide plate, as specified, to facilitate the insertion of the caps into the holes of the holding plate, as set forth. I also claim, in combination, substantially as

specified, the employment of the plate with the series of punches or pins, as specified, for the purpose of forcing all the caps to the required depth in the holding plate."

90. For an *Improved Shingle Machine;* Enoch R. Morrison, Troy, Pennsylvania.

"The nature of my invention consists in carrying the riven shingle forward by an intermittent motion, so as to be operated upon successively by the shaving and edging knives, said motion being imparted by the reciprocating movement of the riving knife stock, through spring hooks, stops or dogs, or their equivalents."

Claim.—"What I claim is, the combination of a reciprocating river and finishing knife with a fixed knife, so that on the backward motion of the river one face of the shingle shall be dressed, and by its next forward motion the second face will be dressed by the fixed knife, substantially as described."

91. For an *Improvement in Platform Scales;* Elnathan Sampson, Cornish, N. H.

Claim.—"What I claim is, the combination of the sliding bars with the platform, the actuating levers, and the scale beam, in such a manner as to enable the platform to be laterally expanded or contracted, substantially as set forth."

92. For *Improvements in Bank Locks;* James H. Crygier, City of New York.

Claim.—"I do not claim the slotted disks, neither do I claim the index plate, nor the manner of adjusting the slotted disks, so that the slots in the disks may be placed in line with the ledges in the bolt, for circular plates having letters or characters upon them arranged with an index plate, have been previously used; neither do I claim the lever guards irrespective of the arrangement shown and described; but what I claim is, 1st, The employment or use of the lever guards, constructed substantially as shown, and arranged so as to operate against the disks, and prevent them from turning as the bolt tumbler is raised, as shown and described in the body of the specification. 2d, I claim connecting the ratchets to the circular toothed disks by means of pawls, and operating said pawls by means of the tumbler, or its equivalent, whereby the ratchets may be connected and disconnected from the several disks simultaneously, and the changes effected with the greatest facility."

93. For an *Improved Life Boat;* Lawrence F. Frazee, New Brunswick, New Jersey.

Claim.—"What I claim is, the combination of the balls as shaped and arranged with respect to each other, as described, with the frame which keeps them in shape and position, and is itself protected by the balsas; said frame being constructed substantially as described, and the whole constituting a life float, having the qualities set forth."

94. For an *Improvement in Grass Harvesters;* Wm. K. Hall, Phillippi, Virginia.

Claim.—"What I claim is, the tram, in combination with the staples on the arms, substantially as described, for the purposes specified."

95. For an *Improvement in Self Acting Presses;* S. R. Holt, Worthington, Ohio.

"The nature of my invention consists in a certain method of constructing a press, whereby the weight of the article being pressed, and also that of a certain portion of the press itself, is rendered available as a motive power for facilitating the operation and increasing the action of the press, and causing it to perform the pressing operation in a very gradual and effectual manner, and thereby save a large amount of the labor now expended in operating the ordinary presses."

Claim.—"I do not claim, in general, the device of making the weight of the article pressed act as the pressing power, by making the press itself rise and fall on a system of levers or other mechanical powers; but what I do claim is, so arranging the lever, and providing it with a self-adjusting follower, in combination with the lever and the bed plate with its supporting frame, that the motion of the article pressed may be transmitted to the long end of the lever, at or near the fixed centre of motion of the frame, causing the weight of the press and article being pressed to exert power on the follower, and thereby gradually press the article into a more compact and solid form, the power being increased, when the weight of the article is not sufficient, by means of the pinion and rack bar, which receive motion from a driving shaft, the whole being constructed, arranged, and operating substantially as set forth."

96. For an *Improvement in Machines for Dressing Mill Stones;* Willard B. Cummings, Tyngsborough, and Nathan P. Dadman, Chelmsford, Assignors to Willard B. Cummings, Tyngsborough, N. P. Dadman, Chelmsford, and Charles A. Blood, North Chelmsford, Massachusetts.

"Our improvement consists in causing the cam which actuates the pick to revolve upon

a block made fast to the stone or the mill bush, which block also serves as the bearing and guide for the head piece, which arrangement entirely prevents any tremulous or other motion from being communicated by the revolution of the cam to the bar, and the parts carrying and giving motion to the pick, which latter may at the same time be guided with the greatest nicety."

Claim.—"What we claim is, the combination of the pedestal, the head piece, and the cam, constructed and operating in the manner substantially as described, and for the purpose set forth."

NOVEMBER 29.

97. For an *Improvement in Fluid Lamps;* Samuel F. Allen, City of New York.

"My improvement consists in making the flame tube of greater length on either side of the vertical wick tube, and in combination with the same, encasing the wick which it carries inside of the fine wire gauze, which serves to give out the fluid in a spread and open state, and consequently to make the light more powerful, or brilliant and open, and also to preserve the wick a great length of time from being charred or consumed."

Claim.—"What I claim is, the horizontal flame tube for burning camphene and like fluid, having a long slit cut in its top, in combination with the wick, when encased in wire gauze, the encasing of the wick in gauze causing the fluid to be discharged and burned in a sheet the full length of the slit, in the manner described."

98. For an *Improvement in Condensing Smoke and Gases;* J. Bloom, East Woburn, Massachusetts.

"The nature of my invention consists in passing the smoke through water, it being conducted in pipes to the hollow of a suitable reservoir, made air-tight and nearly filled with water, which reservoir is kept constantly exhausted by air pumps."

Claim.—"I do not claim the use of revolving fans or blowers for the purpose of forcing air or smoke down through water for the purpose of purifying the same, as this has been tried before and found incapable of producing the desired result, the fan being powerless for the production of pressure to any practicable or useful extent, and will not answer for the purpose; but what I do claim is, passing the smoke of furnace or other fires through water by means of air pumps, in the manner described, and for the purpose set forth."

99. For an *Improved Gold Separator;* M. C. Gritzner, Washington, Dist. of Columbia.

"The nature of my invention consists in the arrangement of two or more screens, one having oblong and the other square meshes, the square meshes to be of the same size of the short diameter of the oblong meshes, for the purpose of separating and retaining the leaf or flake gold, and permitting the balance of the material to be subjected to a blast in uniform or nearly uniform sizes, so as to be differently operated upon by their different specific gravities; also, in the interposition of guide rollers, or their equivalents, between the shaking hopper and the blast, for the purpose of guiding or bringing the material in a proper manner to the blast."

Claim.—"What I claim is, the arrangement of the screens, (two or more,) one having oblong and the other square meshes, the square meshes being of the same size of the short diameters of the oblong meshes, for the purpose of separating and retaining the leaf or flake gold, and permitting the balance of the material to be subjected to the blast in uniform or nearly uniform sizes, so as to be differently operated upon by their different specific gravities, substantially as described. I also claim the interposition of the guide rollers, or their equivalents, between the shaking hopper and the blast, for the purpose of guiding or bringing the material in a proper manner to the blast, substantially as described."

100. For an *Improved Iron Fence;* Benjamin F. Miller, City of New York.

Claim.—"What I claim is, constructing the top and bottom rails in 'lateral halves,' and holding said halves together by screws, rivets, or bolts, in combination with 'bosses' or 'pivots' cast on the inside of the respective halves of the rail, with corresponding 'countersinks' or perforations near the ends of the 'filling bars.' "

101. For an *Improved Trip Hammer;* John W. Peer, Schenectady, New York.

"The nature of my invention consists in raising and lowering the hammer by means of a screw cam arranged upon a circular plate secured fast on a revolving shaft, and connected to the helve of the hammer by means of a horizontal lifting arm, which has one of its ends attached fast to the hammer by set screws, and its other end sliding freely up and

down over the vertical cam shaft as the hammer rises and falls, said arm carrying a small friction roller, which, as the cam shaft revolves, turns freely and plays upon the top of the screw cam, and prevents friction from the weight of the hammer upon the cam, as said hammer is gradually raised by the cam. 2d, In arranging the screw cam upon an adjustable frame, so that it may be adjusted to any position desired, and the length of the blow to be given to the hammer regulated, so that if a full or half blow be required they may be secured."

Claim.—"What I claim is, the arrangement of the screw cam and the adjustable table to which it is attached, for the purposes described."

102. For an *Improvement in Attaching Handles to the Blades of Table Knives;* David M. Ropes, Meriden, Connecticut.

Claim.—"I do not claim the right of soldering or brazing metallic handles on the blades of knives and forks, nor of uniting handles made of other materials in the ordinary way to the bolsters of table knife and other blades by mechanical means, for both of these have heretofore been done; but what I claim is, the use of the metallic cap interposed between the handle and the blade of the knife or fork, and secured to each, substantially in the manner described."

103. For an *Improved Arrangement of Valves, Ports, and Passages, for Operating Steam Hammers;* Robert R. Taylor, Reading, Pennsylvania.

Claim.—"I claim the arrangement, as described, of the steam ports and passages, the variable automatic valve for directing the steam alternately above and below the piston, and for admitting a variable quantity of steam beneath the piston, and the adjustable hand valve, to exclude altogether the steam from above the piston, or to admit a greater or less quantity of it, both valves being adjustable while the hammer is in operation, so that the steam can be made to act with a variable force on either the up and down strokes of the piston, or of both, or prevented from acting on the down stroke, without interrupting the action of the hammer, as set forth."

104. For a *Mode of Applying the Vibratory Spring of Balance Clocks;* Silas B. Terry, Plymouth, Connecticut.

"The improvement consists in the cheapness of construction of the escapement, as compared with the lever escapement and hair spring, as the parts which transmit the motive power of the clock to the balance and govern its vibrations are here combined in one, and the ordinary hair spring is dispensed with; likewise, there is less friction than in the lever escapement, as the impulse imparted by the lever to the balance is in a direct line with the motion of the balance."

Claim.—"What I claim is, the making the crutch spring perform the office of the common hair spring in producing the vibrations of the balance, substantially in the manner set forth."

105. For an *Improvement in Seed Planters;* R. C. Wrenn, Mount Gilead, Ohio.

"The nature of my invention consists in the employment, in the manner described, of the elbow slide shifters attached to the bottom of the slides, in combination with one or more cams arranged fast on the outer faces and near the periphery of the propelling wheels, whereby the slides can be moved inwards and outwards, and made to perform their functions at every quarter, half, or whole revolution of the wheels, as may be desired; by this very simple and utile arrangement, the necessity of employing shifting levers and other complicated mechanism to be operated by hand is dispensed with."

Claim.—"What I claim is, the combination of the slides, cams, and elbow levers or shifters, arranged and operating in the manner described, and for the purpose set forth."

106. For an *Improvement in Coupling Shafts to Axles;* Ephraim B. Benedict, Clinton, New York.

Claim.—"What I claim is, the coupling, consisting of the combination of the clip, tumbler, and draft iron, constructed and arranged as described, for the purpose of a secure and expeditious attachment of the shafts or pole to carriages and other vehicles."

107. For an *Improvement in Combined India Rubber and Steel Springs;* Erastus T. Bussell, Shelbyville, Indiana.

"My invention consists in a combination of vulcanized india rubber with spiral steel, so arranged that each sustains the other, and the good qualities of both are combined so as

to make a most perfect spring for elasticity and durability, which is applicable to railroad cars, carriages, buggies, &c., &c."

Claim.—"I do not claim the surrounding of columns of vulcanized india rubber with detached bands of metal at the ends, or any point between the ends, for springs; nor do I claim originality in the combination of metallic springs with vulcanized india rubber, as these are the subjects of patents heretofore granted to Fowler M. Ray; but as all known forms of such springs and combinations are liable to the following objections: 1st, An incapacity for great motion, this depending upon their outer surface being regular, and surrounded by bands of metal whose diameters are unvarying, together with the incorporating into the centre of said rubber springs, helical or spiral springs of metal, whose diameters increase with their compression, causing them thus to encroach upon the rubber centrifugally. 2d, The liability of such springs losing their elasticity and becoming worthless from the unequal exercise of their different parts; the stretching to their utmost extent the fibres at the circumference, and this at the expense of their vitality, whilst the centrifugal action of the helical spring within, serves further to embarrass it in its movements, so that a large mass of the rubber is rendered inert, by being confined between the almost lifeless circumferal rubber and the centrifugally acting helical spring; the rubber thus circumstanced may properly be compared to an elastic arch with the burthen or force applied to its concave side, without any base upon which to rest, save that of its own external fibres; and, 3d, Their great liability of being crushed by an over load for the want of a continuous metallic support externally; but what I claim is, not the surrounding a column of vulcanized india rubber with a helical spring, as that is the subject of a patent granted to F. M. Ray, but the fluting a column of vulcanized india rubber longitudinally, and then so surrounding it with the helical spring, mine being an improvement upon Ray's spring."

108. For an *Improvement in Stone Saws;* Samuel Chapman, Jr., City of New York.

"The nature of my invention consists in the application, adaptation, and arranging a series of circular saws, attached in alternate countersinks or perforations to the sides near the edge of a straight or the periphery of a circular driving plate, in such a manner as to cut an entire kerf of sufficient width to allow the combination of saws and their fastenings to pass through in like manner as a saw of ordinary construction, changing by this combined arrangement, the cut or working effect of the teeth from the ordinary drawing cut parallel with the line of motion, to the effect or cut of the edge of a chisel or drill driven from, and nearly perpendicular thereto, pressed unto and penetrating the stone in direction, and by force and leverage resulting from motion consequent upon this combined arrangement."

Claim.—"What I claim is, the application, adaptation, and arranging, as described, or in similar manner, a series of circular saws, whereby I obtain from this combination of parts and motions, the desired or above described mode and effect of sawing or severing stone."

109. For an *Improvement in Machines for Washing Ores;* Richard Edwards, Eagle River, Michigan.

Claim.—"What I claim is, the rotating hopper and the suspended oscillating basin, arranged and operated as described."

110. For an *Improvement in Tightening Packing of Engine and Pump Pistons;* John Crabtree and Joseph Hopkinson, Philadelphia, Pennsylvania.

Claim.—"What we claim is, tightening the packing of the piston by the rod passed down through the hollow piston rod and attached to follower, the nuts, key, and hollow piston rod, combined and operating substantially as described."

111. For a *Shingle Machine;* Israel Graves and Charles A. Bogert, West Dresden, N. Y.

"Our invention consists in the employment of a gang of stationary and movable vertical saws hung in an ordinary saw gate, and so arranged, in connexion with cams, or their equivalents, that the movable saws will be caused, as the gate moves up and down, to have a gradual lateral movement from and toward the stationary saws as the stuff is fed in, and also, at the same time a movement out of a parallel line with the direction of feed communicated to them, and they consequently caused to cut in an inclined direction or line, instead of in a direct line, and thereby give the proper shape and taper to the shingle from tip to butt, as described; the said saw gate being operated vertically by a crank and the cams by means of gearing which is attached fast to the saw gate, and moves up and down

with it, and the feed rollers being actuated by gearing arranged on the stationary part of the frame."

Claim.—"What we claim is, a machine for sawing shingles, and which may be adapted to sawing other irregular shapes, constructed with a gang of stationary and movable saws, arranged vertically in a saw gate which moves up and down; the movable saws of said gang being caused to give a gradually lateral movement from and toward the stationary saws while cutting, by means of grooved cams, which operate upon the pintle of the sliding bars, carrying the movable saws, and thereby communicate said lateral movement to them, the said saws at the same time having a movement slightly out of a parallel line with the direction of feed communicated to them by other cams, which operate upon the pintle of the sliding bars, the said movements causing the stuff to be cut tapering, or of any required form, substantially as described."

112. For an *Improvement in Supporting Falling Table Leaves;* Charles Phelps, Salem, Massachusetts.

Claim.—"I do not claim merely the application of a hinged brace for supporting the leaf of a table, as that is a device well known for like purposes; nor do I claim the making it slide in a staple or guiding aperture; neither do I claim the use of a spring for throwing it into its catch, merely as such; but what I do claim is, the application to the falling leaf of a table, of a hinged supporting brace, in the form of a bent lever combined with a spring on the under side for throwing it upward into its catch, whereby the table leaf can be conveniently released to let down by a pull at the short arm of the bent lever, as described."

113. For an *Improvement in Forming Hydraulic Cement Pipes;* John B. Poague and William F. Poague, Fancy Hill, Virginia.

Claim.—"What we claim is, 1st, in combination with the moulds permanently lined with cloth or other porous flexible material, the air spaces intermediately placed between the fastenings of the cloth, so that it may give to the pipe or mould as it is stripped from the pipe, substantially as described; we also claim the manner of withdrawing or stripping the cloth from the inside of the freshly formed pile, by attaching it to the end of the mandrel, so that in withdrawing the mandrel, the cloth will turn inside out and strip from the pipe, substantially as described."

114. For an *Improvement in Machines for Polishing Leather;* Fred. Seibert, Williamsburg, New York.

Claim.—"What I claim is, the circular or curvilinear glass rubber, combined with giving it a tilting motion for the purpose of enabling it, after passing off the edge of the leather at the end of the stroke, to roll back and mount upon the leather without scraping it up, substantially as described."

115. For an *Improvement in Machines for Skiving Boot Counters;* Samuel J. Trofatter and Charles Trofatter, Salem, Massachusetts.

Claim.—"We are are aware that there is nothing new in combining feed and pressure rollers with guides and plane irons or cutters, for the purpose of reducing strips of board or other material; we therefore do not claim such; but what we do claim is, the peculiar arrangement of the axles of the pressure and draft rollers in convergent lines, in combination with the curved guides, as applied to knives; the whole being made to advance a curved piece of leather between the guides with an equality of pressure against the guides, or without such undue pressure against either as would cause one edge of the leather to be bent up and injured or imperfectly cut by the knives, while passing through the machine."

116. For an *Improvement in Combing Fibrous Materials;* J. Heilmann, Administrator of the Estate of Joshua Heilmann, dec'd., of France; patented in France, Dec. 17, '45.

Claim.—"What I claim is, 1st, The segment drum, constructed and arranged substantially as described. 2d, The jaws for griping and presenting the wool properly to the combs to be combed, and in connexion therewith, the bars and comb for delivering the wool. 3d, The rollers, or their equivalent, for seizing and retaining the wool as it is combed, and forming it into a continuous sliver, substantially as described."

117. For an *Improvement in Power Looms;* William Baird, Assignor to John James Hepworth, Philadelphia, Pennsylvania.

"The nature of my invention consists in an arrangement for immediately arresting the forward motion of the lay of a loom when a picker strap breaks, which arrangement at the same time is made to stop the motion of the loom."

Claim.—"I do not claim the method of shifting the driving belt from the fast pulley to the loose, and thus stopping the loom; but what I do claim is, the arrangement of the plate, with its spring, link, staple and pin, so that when a picker strap breaks, the picker staff will relieve the plate, and thus immediately arrest the forward motion of the lay, in the manner described."

118. For an *Improvement in Screw Jacks for Raising Buildings;* Frederick Nicholson, Warsaw, Assignor to Nelson A. Hume, Rushford, New York.

"The nature of my invention is such that a building may be elevated to any required height by means of a screw of convenient length (say two feet, more less,) without blocking up during the process."

Claim.—"What I claim is, the peculiar combination and employment of the hook, the lifting frame, the screw, the divided nuts, and the supporting frame, their combination being such that by the alternate employment of a pair of divided nuts, held stationary in transverse notches of the supporting frame, the screw may be continued up to any desired height, carrying with it the lifting frame, in which it is confined, and which slides in the longitudal grooves of the supporting frame, and carries along with itself the hook, substantially as described."

Re-Issues for November, 1853.

1. For an *Improvement in Planing Machines;* Aretus A. Wilder, Detroit, Michigan; patented 21st Dec., 1852; ante-dated 17th July, 1852; re-issued 15th Nov., 1853.

"The nature of my improvement consists in constructing planing machines so that the board to be planed can be clamped to the reciprocating bed, whilst being fed by the backward motion of the planes, so that the board will be free to move over the stationary bed plate upon which it is planed."

Claim.—"I disclaim the invention of planing by a reciprocating plane which planes on its forward stroke, and feeds the board on its backward stroke, the whole distance of the stroke of the plane, as in other machines of this class; but what I do claim is, 1st, The reciprocating beds arranged with respect to the stationary beds, substantially as described, in combination with the clamps, or their equivalents, attached to them, whereby the board is clamped between said movable beds and the clamps, and is free to move over the stationary planing bed, and is fed during the backward stroke of the planes the whole length of said stroke. 2d, I claim the described method, or any substantially the same, of clamping and feeding lumber to knives or chisels."

2. For an *Improvement in Oil Presses;* David L. Latourette, St. Louis, Missouri; patented Oct. 25, 1851; re-issued Nov. 22, 1853.

Claim.—"What I claim is, 1st, The pipes sliding into and out of stuffing boxes, in combination with the pressing plates, for the purposes and in the manner set forth. 2d, I claim, in combination with the pressing plates, the complete boxes or cases formed on the surface of the plates, as shown, where the openings to the said boxes or cases for the entrance or exit of the substance to be pressed, are closed with the doors and caps, as set forth, the cap sliding over and thus securing the doors when the press is brought into action; this combination, when used in connexion with a horizontal press, enables me to communicate and press the substance and discharge the refuse or cake without the use of bags or mats, and without handling, and at the same time to secure a perfect and free discharge of oil from the entire surface of the cake, through the metallic filterers and vertical channels. I do not claim the arrangement, in a horizontal press, of a series of pressing plates between which the substance is inserted, having been previously enveloped in strong cloths or mats; nor do I claim the arrangement, in a vertical press, of a series of partial cases, into which the substance is inserted, having been previously enveloped in strong cloths or mats, which in both these instances are necessary to convey the substance into the press, and to prevent it from pressing out laterally from between the plates in the one instance, and out at the end and through the cracks in the other."

3. For an *Improvement in Attaching Mineral Vitrifiable Matter to Metal;* Thomas G. Clinton, Assignee (through others) of Joshua Laird, (now deceased,) late of Cincinnati; patented May 22, 1849; re-issued Nov. 22, 1853.

Claim.—"What is claimed is, attaching mineral vitrifiable matter to metal by inserting a metallic tubular shank, involving the characteristics of thinness, yet stiffness enough to resist lateral strain, clasticity and centervent into the mineral vitrified matter, as herein

described, so that the quantity of metal, in proportion to the bulk of mineral, admissible in the case being thus very small, the vitrified mineral enjoys the capacity to embrace and attach itself to the metal without any strain in or upon itself during its crystallization, the difference between the expansibility and contractibility of the metal and the mineral, the one to the other, being also reduced below any practically injurious degree, that is to say, the glass being just as strong with as without such a shank."

Designs for November, 1853.

1. For a *Parlor Stove;* Winslow Ames, Nashua, New Hampshire, Assignors to Hartshorne, Ames & Co., Boston, Massachusetts, November 1, 1853.

Claim.—"The ornamental design of the blower, and that of the fire place front."

2. For a *Parlor Stove;* Ezra Ripley and N. S. Vedder, Troy, Assignors to George W. Eddy, Waterford, New York, November 8, 1853.

Claim.—"The ornamental design and configuration of parlor stove plates."

3. For a *Cooking Stove;* N. S. Vedder, Troy, New York, November 8, 1853.

Claim.—"The ornamental design and configuration of cook stove plates."

4. For a *Sewing Butterfly;* John Lane, New Haven, Connecticut, Nov. 8, 1853.

Claim.—"I claim the device or design of a butterfly bending over a flower, when adapted and arranged for an instrument for holding sewing, or other like work."

5. For *Cooking Stoves;* Simon F. Moore, Batavia, New York, Nov. 29, 1853.

Claim.—"The design herein set forth."

DECEMBER 6, 1853.

1. For an *Improvement in Indicating Electro-Magnetic Telegraphs;* John Davis, New Bedford, Massachusetts.

Claim.—"The improvements which I claim as my invention consist in operating the electro-magnetic telegraph by means of the index or escape wheel, slider, and impeller, as set forth in this specification, and thereby spelling intelligence by pointing out the letters composing the words of the communication on a similar contrivance at the distant office to which the intelligence is sent by telegraph, disclaiming any right to other methods of telegraphing."

2. For an *Improved Arrangement of Screw Cutting Dies in the Die Stocks;* Simeon Goodfellow, New Orleans, Louisiana.

"The improvement as set forth consists in the adaptation to a purpose for cutting bolts and screws with circular dies and cutters, graduated to different sizes, as indicated by numbers thereon. In the stock are inserted two circular reversible dies, made a little tapering from their upper surface downwards; also, a rectangular die tapered in the same direction, (downward,) having a cross head key passing lengthwise and centrally through it, the head of the key (with a small nipper) fitting into a groove and a small hole near the centre of the groove in the small circular die or cutter, and pointing to a centre between the two circular reversible dies."

Claim.—"What I claim is, the arrangement of the circular dies, having threaded scores or recesses in their various depths or sizes in the die stock, substantially as described."

3. For an *Improvement in Pen Holders;* Ebenezer W. Hanson, Spring Garden, Pa.

"The nature of my invention consists in a peculiar mode of constructing a pen holder with thumb and finger rests, or in the application to the barrel of a pen holder, rests or holds for the thumb and middle finger, of a peculiar construction, whereby a better hold and a more easy and certain command of the pen is afforded."

Claim.—"What I claim is, the peculiar mode in which I construct and apply thumb and finger rests to pen holders, viz: I claim making the projecting part of the thumb and finger rests of an oblong or parallelogramic form, so that they shall cross the thumb and finger respectively, when held for use, whether the rest be fixed or made adjustable."

4. For an *Improved Spark Burner and Water Heater for Locomotives;* David Matthew, Philadelphia, Pennsylvania.

"The nature of my invention consists in constructing and providing the engine with an apparatus which receives and consumes the sparks, presents an inner water surface to their fire, an outer and also central water surface to the heat from the flues of the boiler, and heats the feed water in the reservoir or space between these water surfaces for supplying the boiler, by which the sparks are saved and utilized, and the generation of steam increased."

Claim.—"What I claim is, the arrangement and application of the two concentric pipes, the curved plate rings, the pipes, the furnace grate, the cover and pipes, and forming a combined apparatus in the smoke box for burning the sparks and heating the feed water, substantially as described."

5. For an *Improvement in Soap Ingredients;* Ira F. Payson, City of New York.

"The nature of my invention consists in the employment of sal ammoniac in the manufacture of soap, in combination, in part or in whole, with wheat flour, potatoes, borax, sal soda, 'meen fun,' or satin white, and fuller's earth, or their equivalents, the combination being a soap which maintains its consistency in all states of the atmosphere, either moist or dry, and which will wash in water either hard or soft, retaining a sufficient amount of moisture in dry places not to become indurated or yielding too readily to dampness."

Claim.—"What I claim is, the use of sal ammoniac as an ingredient of my soap, in combination with the other ingredients, the effect of which is to retain a sufficient amount of moisture to prevent drying up, and at the same time not enough to cause it to become damp by exposure to damp air."

6. For an *Improved Valve Arrangement for Steam Hammers;* James Watt, South Boston, Massachusetts.

Claim.—" What I claim is, 1st, The revolving valve rod, the barrel, and the adjustable screw stop, constructed, arranged, and operating in the manner substantially as described, by which I am enabled at any instant, to admit the steam beneath the piston during any portion of the fall of the hammer, without altering the effective force and length of the stroke. 2d, I claim, in connexion with the above, the arrangement for throttling the steam on its way from beneath the piston, by which means I am enabled to regulate the intensity of the blow of the hammer to any degree of nicety, or to hold the same suspended above the anvil, in the manner and for the purpose substantially as set forth."

7. For an *Improvement for Cleaning Machine Cards;* George Wellman, Powell, Mass.

Claim.—"What I claim is, in combination with a series of top cards of a carding engine, not only a mechanism for raising one or more of such top cards and holding the same upwards, and afterwards depressing the same back into place, but a mechanism for acting on and cleansing such top card or cards, when or while so elevated, not meaning in the above to claim either the mechanism for moving the top card or cards, or that for cleansing it or them, in their separate combination with the series of top cards, but to lay claim to both in their joint combination, and with the series of top cards, substantially in the manner described. And, in combination with the series of top cards and mechanism for raising and cleansing a top card and restoring it to its seat, I claim the mechanism for moving the raising and cleansing mechanism in succession, from one top card to the other, and whether from one card to the next one throughout the series, or from one to another of them to the next but one, or in any other order, substantially as specified. And I claim the combination of the grooved block, (or the grooves and circular arcs,) the arm with its stud, or the equivalent of said arm and stud, and the notched wheel, as applied to the shafts, and made to operate together, substantially as specified."

8. For an *Improvement in Overshot Water Wheels;* John E. Whitmore, Joliet, Ill.

Claim.—"What I claim is, the construction of the buckets with the covers, operating substantially in the manner and for the purposes specified. Also, the levers, springs, and bolt rods, as described, in combination with the cams, or their equivalents, for closing and opening the buckets, substantially in the manner and for the purposes fully set forth."

9. For an *Improved Mode of Ringing Fixed Bells;* Alfred Carson, City of New York; ante-dated June 6, 1853.

"By my improvement, the nature of which consists in the device for operating the usual

clapper hung at or near the centre of vibration of the bell, by means of a lever that turns on a centre below, and connected with the arm of the clapper by means of a slotted swivel near the upper part thereof, I am enabled to produce the maximum amount of vibration, and in the direction best calculated to impart to the surrounding air the full effect of the vibrations, the clapper being as usual hung at or near the centre of vibration of the bell, and giving its blows inside to communicate to the air outside the first effect of the blows."

Claim.—"I am aware that stationary bells have been rung from the inside, by vibrating the clapper; this I do not claim; but what I do claim is, the device herein described, as applied to the working of the clapper of a bell hung in the usual manner, as set forth."

10. For an *Improvement in Replacing Cars upon Railroad Tracks;* Lucian B. Flanders, Dunkirk, New York.

"The nature of my invention consists in replacing railroad cars and locomotives upon the track, by means of two flanches with inclined bottoms; said flanches being fitted to the rails, and one of the flanches being provided with a movable guide, which, as the car is moved forward and up the inclined flanches, guides the truck to its proper position upon the rails."

Claim.—"What I claim is, replacing railroad cars and locomotives upon the track, or replacing the car wheels upon the rails, in the manner substantially as herein described, viz: by means of flanches having inclined bottoms, and secured or attached to the rails when designed to be used, by the lips or projections on the sides of the flanches; said lips or projections clasping or fitting over the rails; the flanch being provided with a movable guide, which directs or guides the wheels upon the rails, and which guide, by being movable, will act upon the wheels, the flanch being adjusted to either side of the rails."

11. For an *Improvement in Illuminated Clocks;* James Glenn, City of New York.

"The nature of my invention consists in making two circular brass plates, having the figures of time cut through them, one plate having the hour figures only, cut in Roman characters, the other plate having the minute figures only, cut in Arabic characters, both of which are made to revolve by clock-work between the light of a lamp, or gas light, and two magnifying lenses, which throw the images of two divisions of the minute figures, and one division of the hour figures, on a screen or plate of ground glass in front; the figures are thus represented in light, and are seen more distinctly than by any other method at present in use."

Claim.—"What I claim is, the construction of two circular dial plates, having the figures of time cut through them in such a manner, which, being made to revolve by means of clock work, and by means of a light and two magnifying lenses, the time is represented on a plate of ground glass in front in white light, which may be perceived to a greater distance, and more distinctly, than by any other method at present in use, whether used with or without a magnifying lens."

12. For an *Improvement in Shower Syringes;* Ira Warren, Boston, Massachusetts.

Claim.—"What I claim is, a new and useful surgical instrument for the treatment of diseases of the air passages of the throat and nose, is the above syringe, constructed of the form and of the materials described, for the objects set forth."

13. For *Improvements in Cutters for Planing Mouldings;* R. M. Evans, Guilford, New Hampshire, Assignor to himself and Asa Weeks, South Boston, Massachusetts.

Claim.—"I do not claim making the cutters of shapes suited to the different parts of the article to be turned, either straight or curved, and securing them to a cutter wheel; but what I do claim is, making the cutting irons of moulding planes or turning tools of thin sections, in the manner described, which, after being set to a pattern and confined in clamps, may be brought to an exact edge by filing or grinding, in the manner and for the purpose substantially as set forth."

14. For an *Improvement in Condensers for Stills;* Carl E. Werner, New Castle, Ill.

Claim.—"What I claim is, the construction of the condenser, consisting of an outer upright cylinder with its upper chine projecting above the head, so as to form a circular trough, and an inner refrigerating cylinder, traversed by vertical tubes, which connect the vapor spaces above and below, the whole being situated above, and discharging the condensed fluid back into the rectifier."

MECHANICS, PHYSICS, AND CHEMISTRY.

Description of some New Kinds of Galvanic Batteries. Invented by Mr. Kukla, of Vienna.*

The combination used in one of these, is antimony, or some of its alloys, for a negative plate, with nitric acid of specific gravity 1·4, in contact with it, and unamalgamated zinc, for a positive plate, with a saturated solution of common salt in contact with it. A small quantity of finely powdered per-oxide of manganese is put into the nitric acid, which is said to increase the constancy of the battery. The alloys of antimony which Mr. Kukla has experimented with successfully are the following:—Phosphorus and antimony, chromium and antimony, arsenic and antimony, boron and antimony. These are in the order of their negative character, phosphorus and antimony being the most negative. Antimony itself is less negative than any of these alloys. The alloys are made in the proportions of the atomic weights of the substances. All these arrangements are said by Mr. Kukla to be more powerful than when platinum or carbon is substituted for antimony or its alloys. In this battery a gutta percha bell cover is used over the antimony, and resting on a flat ring floating on the top of the zinc solution,—this effectually prevents any smell, and keeps the per-oxide of nitrogen in contact with the nitric acid solution. When a battery of twenty-four cells was used, Mr. Kukla found that in the third and twenty-first cells pure ammonia in solution was the ultimate result of the action of the battery; but only water in all the others. This experiment was tried repeatedly, and always with the same result. A battery was put into action for twenty-four hours,—at the end of that time the nitric acid had lost thirteen-twentieths of an ounce of oxygen, and one-quarter of an ounce of zinc was consumed. Now as one-quarter of an ounce of zinc requires only 0·06 of an ounce of oxygen to form oxide of zinc, Mr. Kukla draws the conclusion, that the rest of the oxygen is converted directly into electricity; and this view, he says, is confirmed by the large amount of electricity given out by the battery in proportion to the zinc consumed in a given time. In the above battery each zinc plate had a surface of forty square inches. The addition of per-oxide of manganese does not increase the effect of the battery, but it makes it more lasting—the per-oxide of nitrogen, formed in the bell cover, taking one atom of oxygen from the per-oxide of manganese;—this is evident from only the oxide of manganese being found in the battery after a time: in the salt solution no other alteration takes place than what is caused by the oxide of zinc remaining in a partly dissolved state in the solution. For this batterry Mr. Kukla much prefers porous cells, or diaphragms of biscuit ware, as less liable to break, and being more homogeneous in their material than any other kind. This battery is very cheap, antimony being only 5*d.* per lb., wholesale, and the zinc not requiring amalgamation.—The second arrangement tried by Mr. Kukla was antimony and amalgamated zinc with only one exciting solution, viz. concentrated sulphuric acid:—this battery has great heating power, and the former great magnetizing power:—it, however, rapidly decreases in power, and is not so practically useful as the double fluid battery, which

* From the London Athenæum, October, 1853.

will exert about the same power for fourteen days, when the poles are only occasionally connected as in electric telegraphs. Certain peculiarities respecting the ratio of intensity to quantity when a series of cells is used, have been observed, which differ from those remarked in other batteries.—Mr. Kukla, on directing his attention to the best means of making a small portable battery for physiological purposes, has found very small and flat Cruikshank batteries, excited by weak phosphoric acid (one of glacial phosphoric acid to twenty of water), to be the best. phosphoric acid being very deliquescent, and forming with the zinc; during the galvanic action, an acid phosphate of zinc. A battery of this description does not decrease in power very materially until it has been three hours in action.

On the Elasticity of Stone and Crystalline Bodies. By E. Hodgkinson.*

It is generally assumed by writers on the strength of materials, that the elasticity of bodies is perfect, so long as the material is not strained beyond a certain degree. But from the experiments I made several years ago, at the instance of the British Association, on the strength of hot and cold blast iron (vol. vi.), I was led to conclude that the assumption was very incorrect, as applied to cast iron at least; and further experiments rendered it probable that it was only an approximation in any. Among the bodies of most value in the arts, cast iron holds an important place; and I found that bars of that metal, when bent with forces, however small, never regained their first form, after the force was removed; and this defect of its elasticity took place whether the cast iron was strained by tension, compression, or transverse flexure. I subsequently found that in the first two strains (by tension and compression), the straining force might be well represented by a function composed of the first and second powers of the change of length produced,—thus,

$$w = ae - be^2$$
$$w = a'c - b'c^2$$

where w is the weight applied, e the extension, c the compression, and a, a', b, b' constant quantities. If the elasticity were perfect, the part depending on the second power must be neglected. The necessity of a change in the fundamental assumptions for calculating the strength of materials may be inferred from the fact, that in computing the breaking weight by *tension*, from experiments on *transverse* flexure and fracture, we obtain the strength of cast iron three times as great as from numerous experiments I have found it to be. The formulæ of Tredgold give this erroneous result, and those of Navier are in accordance with them.

Stone.—To obtain the elasticity of stone, I had masses of soft stone, obtained from various places, sawn up into broad thin slabs, 7 feet long, and about 1 inch thick. They were rubbed smooth, and rendered perfectly dry in a stove, and were bent transversely in their least direction by forces acting horizontally. The slabs, during the experiments, were placed with their broad side vertical, and had their ends supported, 6 feet 6 inches asunder, by friction rollers, acting horizontally and vertically. It resulted from the experiments (as shown in a former volume of this Association), that the defects of elasticity were nearly as the square of the

* From the London Athenæum, October, 1853.

weight laid on; or consequently, as the square of the deflexion nearly, as in cast iron. The ribs never regained their first form after the weight was removed, however small that weight had been. From other ribs of stone, obtained from various localities, and broke transversely by weights, acting vertically, and increased to the time of fracture, the ratio of the deflexion to the weights applied were found in various experiments to be nearly as below:—

·02	·01	·02	·018	·02	.027
·035	·012	·022	.023	·022	·032
·05	·0125	·033	.024	·024	·035
·07	·014	·036	·027	·025	·038
·09	·015			·026	
·11	·016				

The ratio represented by the numbers in each vertical column, are those in each separate rib of stone; and they would have been equal if the elasticity had continued perfect, but they were increasing where the weights were increased in every instance. The change shown by these experiments to be necessary would increase considerably the mathematical difficulties of the subject; and they would be greater still, if the change of bulk and lateral dimensions in the bodies strained were included, according to the conclusions of Poisson, or the experiments of Wertheim, which are at variance with each other. But these changes are so small in the bodies I am contemplating, that they may be neglected for all practical purposes. Thus, from my experiments, the utmost extension of a bar of cast iron, 50 feet long, is about 1 inch, or $\frac{1}{600}$th of the length, and therefore the change of lateral dimensions of the bar being only a fraction of this $\frac{1}{600}$th, according either to Poisson or Wertheim, it is too small to need including. The experiments in which I deduced the utmost extension of cast iron, are given in the 'Report of the Commissioners on the Strength of Iron for Railway Purposes.' If the body strained were wrought iron, brass, or others of a very ductile nature, the change of lateral dimensions might, in extreme cases, be included. I beg to mention, with great deference, that the profound work of Lamé, lately published on 'The Mathematical Theory of Elasticity,' in which the elasticity is considered as perfect only, does not appear to apply to such bodies as I have here treated of.

Report on the Gases evolved in Steeping Flax, and on the Composition and Economy of the Flax Plant. By Prof. Hodges.*

The investigations directed by the Association, at the Belfast Meeting, with respect to the gases evolved in the steeping of flax and the composition of flax straw are in progress, and will be reported at the next meeting. The gases of the fermenting vat have been analyzed by the methods of Prof. Bunsen, and have been found to consist of carbonic acid, hydrogen and nitrogen. No sulphuretted hydrogen has, in any case, been detected. Several analyses of the proximate constituents of the dress fibre and of its inorganic ingredients have been made, which show that a considerable amount of the nitrogenized and other constituents of the plant are retained in the fibre even after steeping and dressing have removed the structures unsuitable for textile purposes.

* From the London Athenæum, October, 1853.

For the Journal of the Franklin Institute.

The Transatlantic Steamship Franklin, trading between New York and Havre. By B. F. Isherwood, Chief Eng., U. S. N.

By the kindness of Mr. L. S. Bartholomew, I have become possessed of the steam logs of the *Franklin* for the voyages during which he was Chief Engineer of that vessel. Taken in connexion with exact dimensions of the hull, machinery, &c., these authentic logs, with the results deducible from them, will be of interest to the marine engineer.

The following are the dimensions of the hull and machinery:

Hull.

Length on deck,	263 feet.
Breadth of Beam,	41 " 10 in.
Depth of hold,	26 "
Mean load draft of water on leaving port,	19 " 5 in.
" draft of water on arriving in port,	16 " 3 "
" " " for the voyage,	17 " 10 "
Immersed amidship section, at 17 feet 10 inches draft of water,	609 square feet.
Displacement per inch at 17 feet 10 inches draft of water,	17 tons.

Engines.—Two side lever engines, with balanced poppet valves.

Diameter of cylinders,	93 inches.
Stroke of pistons,	8 feet.
Space displacement of both pistons per stroke,	754·768 cubic feet.

The steam was cut off in the cylinder with the steam induction valve by Stillman and Allen's arrangement. The engines, boilers, &c., were designed and constructed at the Novelty Works, New York.

Boilers.—Four in number, of the double return drop kind, placed in pairs, back to back, with one smoke chimney in common. The boilers are of iron, with circular shells the entire length.

Diameter of each boiler,	12 feet 9 in.
Length of "	22 "
Number of furnaces in each boiler,	3.
Total area of heating surface in the four boilers,	8528 sq. feet.
Length of the fire grates,	7 feet.
Total area of grate surface in the four boilers,	300 sq. feet.
Aggregate cross area of the two first, or upper rows of flues,	57 " "
" " " " middle rows of flues,	46 " "
" " " " lower rows "	$43\frac{1}{3}$ " "
Distance traversed by the heated gases, from the centre of the furnaces, to their delivery into the chimney,	$41\frac{1}{2}$ feet.
Average diameter of the flues,	1·216 "
Cross area of the smoke chimney,	50 sq. feet.
Height of the smoke chimney above the grates,	63 feet.

Proportions.

Proportion of heating to grate surface,	28·427 to 1·000
" grate surface to cross area of two upper rows of flues,	5·263 "
" " " " " middle "	6·522 "
" " " " " lower "	6·923 "
" " " " the smoke chimney,	6·000 "
Length of the distance traversed by the heated gases in proportion to the diameter of the flues,	$34\frac{1}{8}$ to 1·

Paddle Wheels—Of the common radial kind.

Diameter from outside to outside of paddles,	32 feet 2 in.
Number of paddles in each wheel,	28
Length of each paddle,	11 feet 8 in.
Width " "	2 "
Area of two paddles,	$46\frac{2}{3}$ sq. feet.
Immersion of the lower edge of paddles at 17 feet 10 in. draft,	6 feet 8 in.
Number of paddles in water " " "	8 1-6
Area of all immersed paddles " " "	190·55 sq. feet.
Distance from centre to centre of paddles measured on periphery,	3·6 feet.

Eleventh Voyage from New York to Havre.

DATE. 1852.	Av. steam press. in boils. in lbs. pr sq. in. ab. atm.	Total number of revolutions of the wheels, taken by counter.	Pounds of coal consumed.	Distance run in geographical miles by observation.	Steam cut off at in steam cylinders from com. of stroke of pistons in feet.	Latitude.	Longitude.	Running time in hours and minutes.	Wind.	Sail.	Sea.
May 8	14·7	19826	115720	250	2·1	40° 35′	69° 06′	23 39	Light, for'd. beam.	Fore and aft.	Smooth.
" 9	16·0	19666	118220	240	2·1	—	—	23 43	" "	"	"
" 10	15·5	18310	114300	244	2·1	—	—	23 36	" "	"	"
" 11	16·0	19920	113520	255	2·1	43 28	52 13	23 35	" "	"	"
" 12	16·0	20420	126675	263	2·1	45 18	46 36	23 37	Light wind ahead.	None.	Very smth
" 13	16·9	20473	119139	234	2·1	47 10	40 19	23 35	Mod. wind abeam.	All sail.	Moderate.
" 14	13·5	19667	118784	282	2·6	48 25	33 33	23 33	Strong wind ab'm.	"	Rough.
" 15	12·0	19499	111872	279	2 6	48 36	26 36	23 32	" "	"	"
" 16	15·0	20132	117000	291	2·1	49 25	19 16	23 31	" "	"	"
" 17	15·0	22087	118350	302	2·1	49 54	11 34	23 29	" "	"	"
" 18	15·0	22433	115200	291	2·5	—	—	23 38	" "	"	"
" 19	16·3	20306	107550	280	2·1	—	—	22 00	" "	None.	Smooth.
Totals		242730	1396330	3261				281 28			
Means	15·1	14·373 pr. mn	4961 pr hour.	11·586 pr hr.	2·22						

Eleventh Voyage from Havre to New York.

DATE. 1852.	Av. steam press.	Total revolutions	Pounds of coal consumed.	Distance run	Steam cut off	Latitude.	Longitude.	Running time	Wind.	Sail.	Sea.
June 8	17·0	7347	58000	90	2·1	—	—	10 30	Light head wind.	No sail.	Smooth.
" 9	17·0	16603	89250	224	2·1	50 00	6 50	24 05	" "	"	"
" 10	16·0	20008	110000	273	2·1	50 32	13 53	24 28	Light for'd beam.	Fore and aft.	"
" 11	16·7	20568	103320	273	2·1	50 44	20 50	24 28	" "	"	"
" 12	17·5	18097	109525	205	2·1	50 45	26 14	24 22	" "	"	Moderate.
" 13	16·5	16264	99025	183	2·1	50 46	31 05	24 19	Strong head wind.	No sail.	Heavy.
" 14	16·3	17927	103530	179	2·1	49 26	35 19	24 17	" "	"	"
" 15	16·0	18613	121380	211	2·1	48 27	40 28	24 21	" "	"	Rough.
" 16	15·5	21956	102090	280	2·1	47 23	47 13	24 27	Mod. for'd. beam.	Fore and aft.	Moderate.
" 17	16·0	22629	107070	292	2·1	46 27	54 13	24 28	Light head wind.	No sail.	Smooth.
" 18	15·5	23126	103910	290	2·1	44 45	60 27	24 25	{ Light aft. 12 hs. / Light head wind.	{ Sail 12 hs. / No sail.	"
" 19	15·3	22236	106596	290	2·1	—	—	24 25	" "	No sail.	"
" 20	14·3	22436	94710	209	2·1	40 40	72 20	23 50	Light for'd. beam.	Fore and aft.	"
" 21	14·0	7576	32340	100	2·1	—	—	8 00	" "	"	"
Totals		256386	1340716	3189				310 25			
Means	16·0	13·766 pr mn	4319 per hr.	10·273 pr hr.	2·10						

Twelfth Voyage from New York to Havre.

DATE. 1852.	Av. steam press.	Total revolutions	Pounds of coal consumed.	Distance run	Steam cut off	Latitude.	Longitude.	Running time	Wind.	Sail.	Sea.
July 3	15·3	18077	102907	255	2·2	40 50	68 59	23 00	Mod. wind abeam.	All sail.	Smooth.
" 4	16·0	19838	97580	259	2·3	42 44	63 37	23 39	Light wind aft.	"	"
" 5	17·0	20098	109120	261	2·3	44 58	58 27	23 39	Light wind abeam.	"	"
" 6	17·0	20688	107940	272	2·4	46 36	52 22	23 36	Light wind ahead.	None.	"
" 7	17·0	21330	118360	280	2·4	48 21	45 58	23 34	Light wind abeam.	All sail.	"
" 8	16·8	21463	112500	302	2·3	49 38	38 34	23 30	" " "	"	"
" 9	17·3	21393	115650	286	2·3	50 40	31 14	23 31	Light for'd. beam.	Fore and aft.	"
" 10	16·2	21492	110550	294	2·3	50 49	23 32	23 29	Light breeze aft.	All sail.	Moderate.
" 11	16·5	21406	104360	287	2·3	50 45	16 02	23 30	Mod. wind abeam.	"	"
" 12	16·8	23443	115680	289	2·1	50 07	8 36	23 30	Light wind ahead.	None.	Smooth.
" 13	16·2	24156	109800	289	2·1	—	—	23 00	" " "	"	"
Totals		233384	1213387	3074				257 58			
Means	16·0	15·079 pr mn.	4704 pr hour.	11·916 pr hr.	2·28						

Twelfth Voyage from Havre to New York.

DATE. 1852.	Av. steam press. in boils. in lbs. pr sq. in. ab. atm.	Total number of revolutions of the wheels, taken by counter.	Pounds of coal consumed.	Distance run in geographical miles by observation.	Steam cut off at in steam cylinders from com. of stroke of pistons in feet.	Latitude.	Longitude.	Running time in hours and minutes.	Wind.	Sail.	Sea.
Aug. 4	17·0	17916	111360	225	2·5	—	—	24 26	Fresh br. for'd. bm.	Fore and aft.	Moderate.
" 5	15·5	17824	119040	225	3·2	50 31	10 25	24 26	Strong wd. fo'd. bm.	"	Rough.
" 6	15·3	17140	111600	207	3·5	50 15	15 47	24 22	Strong wind ahead.	None.	"
" 7	15·0	17584	111780	193	3·6	50 14	20 47	24 20	" "	"	Heavy.
" 8	15·3	19793	110700	232	2·9	49 44	26 46	24 24	" "	"	"
" 9	15·5	21184	109940	282	2·4	49 07	33 52	24 28	Mod. for'd beam.	Fore and aft.	Moderate.
" 10	15·3	22192	113160	292	2·6	48 53	41 17	24 30	Light wind abeam.	All sail.	"
" 11	15·3	21778	110450	260	2·6	48 00	47 30	24 25	Light wind ahead.	None.	"
" 12	16·0	22680	113160	296	2·5	46 03	54 09	24 27	Mod. wind abeam.	All sail.	"
" 13	16·3	23940	119850	286	2·5	44 43	60 41	24 26	Light wind ahead.	None.	"
" 14	16·5	24388	113850	296	2·6	42 00	66 19	24 25	" "	"	Smooth.
" 15	16·0	24528	113620	296	2·4	40 24	72 19	24 24	" "	"	"
" 16	16·0	6813	24840	74	2·4	—	—	6 00	" "	"	"
Totals		257760	1383350	3164				299 00			
Means	15·8	14·370 pr mn.	4627 pr hour.	10·582 pr. hr.	2·77						

Thirteenth Voyage from New York to Havre.

DATE.	Av. steam press.	Total revolutions	Pounds of coal	Distance	Steam cut off	Latitude.	Longitude.	Running time	Wind.	Sail.	Sea.
Au. 28	16·0	17416	112220	232	2·5	40 35	69 29	22 56	Light for'd. beam.	Fore and aft.	Moderate.
" 29	16·0	18542	112220	262	2·4	42 46	64 25	23 40	" "	"	"
" 30	16·0	16700	110400	225	2·3	44 38	60 13	23 43	" "	"	"
" 31	16·0	18965	120520	250	2·2	45 20	56 06	23 44	" "	"	"
Sept. 1	15·8	19706	119140	269	2·0	47 12	48 28	23 29	Light wind for'd. beam. 8 hs. calm.	Fore & aft. 8 hs. No sail.	Smooth.
" 2	16·0	20505	117000	225	2·2	48 23	43 13	23 40	Light for'd. beam.	Fore and aft.	Moderate.
" 3	16·0	19375	117300	272	2·3	49 17	36 28	23 35	Strong for'd. beam.	"	Rough.
" 4	16·0	21851	119140	288	2·0	50 21	29 14	23 31	Mod. wind abeam.	All sail.	Moderate.
" 5	16·0	21338	113280	286	2·1	50 30	21 [illegible]	23 31	Light wind aft.	"	"
" 6	16·0	21972	125120	276	2·1	54 35	14 29	23 32	Light for'd. beam.	Fore and aft.	"
" 7	16·0	22436	120600	281	2·1	49 34	7 26	23 32	" "	"	Smooth.
" 8	16·0	22589	121050	280	2·1	—	—	22 50	" "	"	"
" 9	16·4	7327	36960	90	2·1	—	—	7 15	" "	"	"
Totals		248722	1444950	3236				288 50			
Means	15·6	14·352 pr mn.	5003 pr. hour.	11·203 pr. hr.	2·19						

Thirteenth Voyage from Havre to New York.

DATE.	Av. steam press.	Total revolutions	Pounds of coal	Distance	Steam cut off	Latitude.	Longitude.	Running time	Wind.	Sail.	Sea.
Sep 28	15·0	1203	21190	11	2·5	—	—	1 45	Strong w'd. abeam.	None.	Moderate.
" 29	15·0	17512	110530	151	2·9	49 56	4 45	24 18	Fresh for'd. beam.	Fore and aft.	"
" 30	15·3	19511	111320	255	2·8	50 29	11 26	24 27	Mod. wind ahead.	None.	Smooth.
Oct. 1	15·5	19179	113080	288	3·1	50 30	18 08	24 27	Mod. for'd. beam.	Fore and aft.	Rough.
" 2	15·8	19097	112640	261	2·7	—	—	24 26	" "	"	Moderate.
" 3	16·0	18446	114840	217	3·1	50 08	30 33	24 23	Strong for'd. beam.	"	Rough.
" 4	16·0	20265	115720	247	2·5	49 28	36 51	24 25	Light abm. 16 hs. Strong head w'd.	Sail for 16 hs. No sail.	Moderate.
" 5	15·8	21694	113320	271	2·4	48 41	43 37	24 27	Light for'd. beam.	Fore and aft.	"
" 6	15·7	22291	117040	290	2·6	47 24	50 31	24 28	Mod. wind abeam.	All sail.	"
" 7	15·5	22026	121951	279	2·4	45 40	56 47	24 25	Calm.	None.	Smooth.
" 8	16·0	23891	123300	294	2·6	43 19	62 59	24 25	Light for'd. beam.	Fore and aft.	"
" 9	15·5	24067	125550	302	2·4	40 47	68 52	24 24	" "	"	"
" 10	15·2	19991	103950	285	2·1	—	—	21 00	" "	"	"
Totals		249170	1404431	3151				291 20			
Means	15·6	14·255 pr mn.	4827 pr. hour.	10·816 pr. hr.	2·63						

SUMMARY OF THE STEAM LOGS OF THE FRANKLIN.

From New York to Havre.

Voyage.	TOTALS. Length of voyage in hours and minutes.	Length of voyage in geographical miles, by observation.	No. of revolutions made by the wheels during the voyage, by counter.	Amount of coal consumed during the voyage, in tons and pounds.	MEANS. Average steam press. in boils. in lbs. per sq. in. above atmosphere.	Steam cut off at in cylinders from com. of stroke of pistons in feet.	Number of revolutions of the wheels made per minute.	Speed of the vessel in geographical miles per hour.	Consumption of coal in pounds per hour.	Consumption of coal per 24 hours in tons and pounds.	Slip of the paddle wheel in per centums of its speed.	Horses power developed by the engines.	Mean effective pressure on pistons throughout stroke, in pounds per square inch.
11th.	281 28	3261	242739	623 810	15·1	2·22	14·373	11·586	4961	53 344	15·30	1342·16	14·17
12th.	257 58	3074	233384	541 1547	16·6	2·28	15·079	11·916	4704	50 896	16·96	1528·61	15·39
13th.	288 50	3236	248722	645 250	15·6	2·19	14·352	11·203	5003	53 1352	17·97	1344·32	14·22
Totals	828 16	9571	724845	1810 367									
Means					15·7	2·23	14·586	11·555	4895	52 1000	16·75	1399·90	14·57
From Havre to New York.													
11th.	310 25	3189	256386	598 1196	16·0	2·10	13·766	10·273	4319	46 616	21·58	1286·74	14·19
12th.	299 00	3164	257760	617 1270	15·8	2·77	14·370	10·582	4627	49 1288	22·60	1587·39	16·77
13th.	291 20	3151	249170	626 2191	15·6	2·63	14·255	10·816	4827	51 1608	20·27	1536·18	16·36
Totals	900 45	9504	763316	1843 177									
Means					15·8	2·50	14·124	10·551	4583	49 232	21·50	1465·29	15·75

Remarks on the Steam Logs.—The throttle valve was carried wide open, and the general correspondence of a great number of indicator diagrams shows the steam pressure in the cylinders to have been $3\frac{1}{2}$ lbs. less than in the boilers; the lift of the valves, and consequently the opening, is considerably reduced when cutting off from $\frac{1}{4}$ to $\frac{1}{3}$. From the same source it also appears, that the mean effective pressure on the pistons throughout the stroke was 1·8 lbs. per square inch greater than what was due to the theoretical expansion curve; this 1·8 pounds includes the effect of the steam in the nozzles and clearances of the cylinders, and of the leakages of the steam valves, &c. The vacuum in the condensers per gauge was 25 inches of mercury, and the back pressure in the pistons 4·2 lbs. per square inch.

The temperature of the feed water was maintained at 120° Fah. The fuel was burned with the natural draft.

The distances run were determined by observation from meridian to meridian, and the length of the geographical mile on the 45th degree of latitude is taken from Frome at 6115·8 feet.

The easterly voyages are all between New York and Havre, except the twelfth, which is from New York to Cowes. The return voyages are all from Havre to New York.

By observing the *Summary*, it will be perceived that the weather was much more favorable during the voyages *from New York to Havre*, than on the return; the mean speed in the former being 11·555 miles per hour, and in the latter 10·551 miles per hour, or 9·51 per centum of the latter less. The mean slip of the centre of pressure of the paddles in the voyages *from New York to Havre*, was 16·75 per centum of its speed, while

in the return voyages it was 21·50 per centum, or 28·36 per centum of the latter more. The less resistance on the voyages *from New York to Havre* than on the return, is also shown by the greater mean effective steam pressure on the pistons required during the latter, to produce an equal number of revolutions of the wheels in a given time. All the voyages given in the logs were made under very favorable circumstances of wind and sea.

The quantity of coal carried was 950 tons, and the average consumption per voyage 609 tons, leaving an overplus for extraordinarily unfavorable weather of 341 tons, or about $6\frac{3}{4}$ days' additional steaming; the whole amount of fuel carried being sufficient for nearly 19 days' steaming.

The consumption of the engineer's stores for each 24 hours' steaming was as follows, viz: oil, $7\frac{1}{2}$ gallons; tallow, $15\frac{1}{6}$ lbs.; wiping stuff, 6 lbs.

On the voyages *from New York to Havre*, sail was set for 696 hours 4 minutes out of the 828 hours 16 minutes, or for 84 per centum of the time. On the voyages *from Havre to New York*, sail was set for 495 hours ten minutes out of the 900 hours 45 minutes, or for 55 per centum of the time.

Evaporation by the Boilers.—The fuel consumed on the voyages *from New York to Havre*, was Cumberland bituminous coal; that consumed on the return voyages, *from Havre to New York*, was the English bituminous coal, almost identical in its chemical constitution, and giving sensibly the same evaporation.

In calculating the evaporation, the steam pressure in the cylinders before cutting off and at the point of cutting off, are determined from a large number of indicator diagrams. The number of double strokes of pistons made was taken from the counter. The temperature of the feed water was carried by thermometer at 120° Fah.; and the weight of coal consumed was ascertained for each watch of four hours by measurement in a large tub, verified at the close of the voyage by a comparison of the remainder with the amount taken in. Regnault's determination of the total heat of steam is used, and the evaporation includes the waste steam (40 cubic feet in one end of both cylinders) in the cylinder nozzles, clearance, &c., and also the loss by *blowing-off*, to maintain the sea water in the boilers at $1\frac{3}{4}$ the natural concentration.

Evaporation by the Cumberland Bituminous Coal.—For this calculation we have the following DATA, viz:—

Length of time consuming the coal,	828 hours 16 minutes.
Quantity of coal consumed, (tons, 2240 pounds,)	1810 tons 367 pounds.
Number of double strokes of pistons made,	724,845
Steam pressure in cylinders per square inch above atmosphere before cutting off,	12·2 pounds.
Steam cut off at in cylinders from commencement of stroke,	2·23 feet.

From which we obtain the following RESULTS, viz:—

Cubic feet of steam of atmospheric pressure furnished per minute,	14,884·940
Pounds of steam evaporated per hour by one square foot of heating surface,	3·850
Pounds of steam evaporated per hour, by one pound of coal,	6·707
" coal consumed per hour per square foot of heating surface,	0·574
" " " " " " grate "	16·317

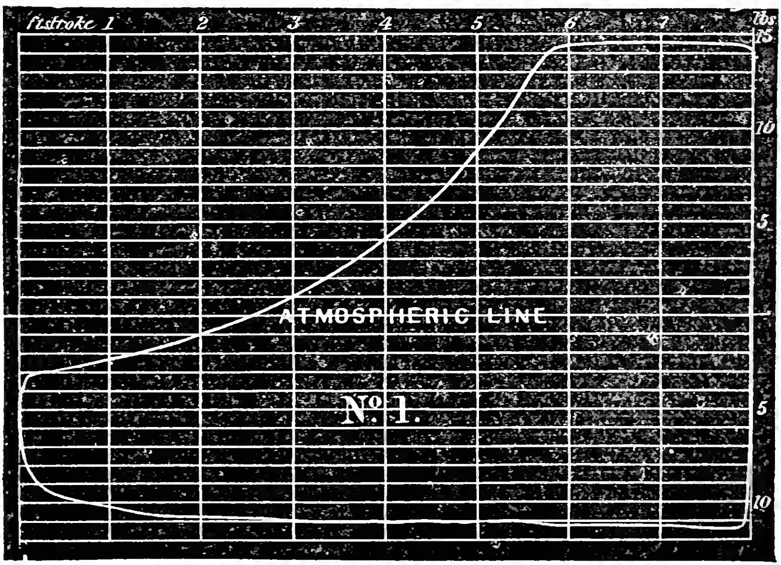
Evaporation by the English Bituminous Coal.—For this calculation we have the following DATA, viz:—

Length of time consuming the coal, .	900 hours 45 minutes.
Quantity of coal consumed, (tons, 2240 pounds,)	1843 tons 177 pounds.
Number of double strokes of pistons made, .	763,316
Steam pressure in cylinders, per square inch above atmosphere, before cutting off, . .	12·3 pounds.
Steam cut off at in cylinders from commencement of stroke,	2·50 feet.

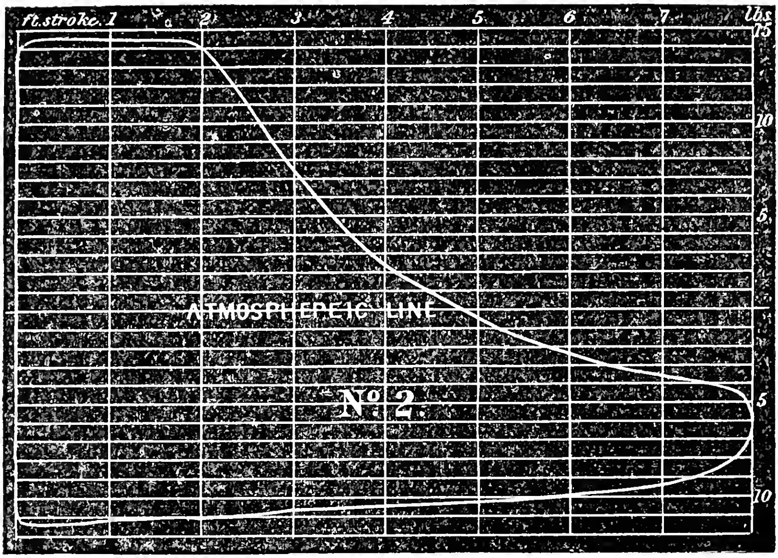
From which we obtain the following RESULTS, viz:—

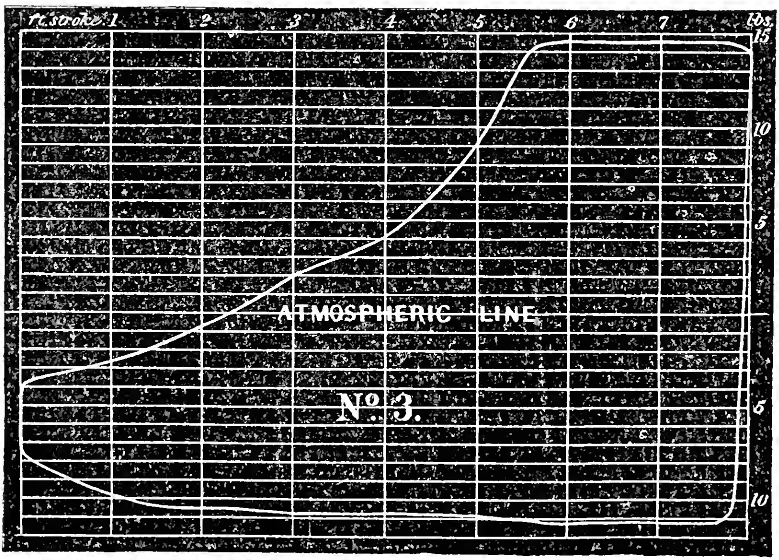
Cubic feet of steam of atmospheric pressure furnished per minute.	15,879·387
Pounds of steam evaporated per hour, by one square foot of heating surface, ...	4·107
Pounds of steam evaporated per hour by one pound of coal. .	6·885
" coal consumed per hour, per square foot of heating surface,	0·538
" " " " " " grate "	15·277

Indicator Diagrams.—The diagrams numbered 1, 2, 3, and 4, were taken from the steam cylinders with the throttles wide open, and serve to show the manner of using the steam under the ordinary conditions of practice. No. 1 was taken from the upper end of the port cylinder; No. 2 was taken from the lower end of the port cylinder; No. 3 was taken from the upper end of the starboard cylinder; No. 4 was taken from the lower end of the starboard cylinder. The steam pressure in the boiler above atmosphere was 18 pounds per square inch, and the number of

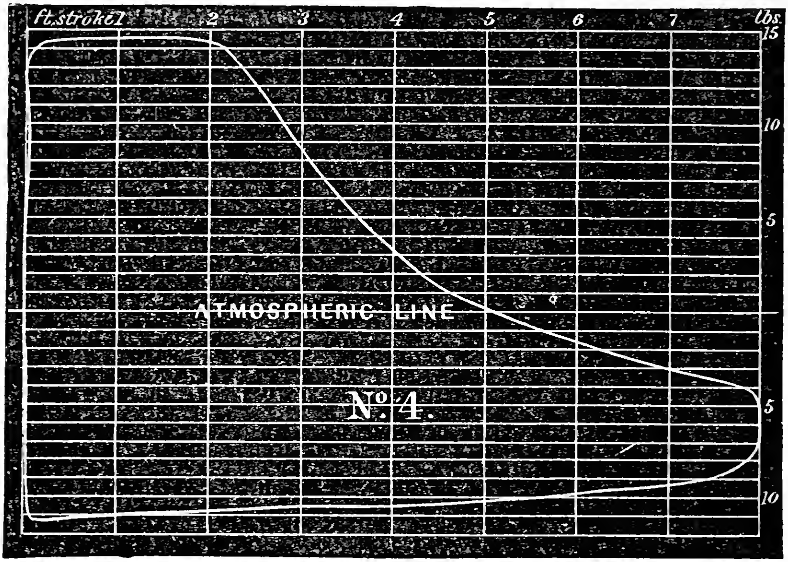


double strokes of piston made per minute 14. The vacuum in the condensers per gauge was 25 inches of mercury; temperature of the feed water 120° Fah. The steam pressure in the cylinders before cutting off is $3\frac{1}{2}$ pounds per square inch less than the boiler pressure, and the mean back pressure (4·2 pounds per square inch) against the pistons is 2 lbs. per square inch more than the back pressure in the condensers. The


ft. stroke. 1
2
3
4
5
6
7
lbs.
15
10
5
ATMOSPHERIC LINE
5
10
No. 2.


ft. stroke. 1
2
3
4
5
6
7
lbs.
15
10
5
ATMOSPHERIC LINE
5
10
No. 3.

mean effective pressures throughout the stroke per square inch of pistons are as follows, viz: No. 1, 16·6 lbs.; No. 2, 15·0 lbs.; No. 3, 16.7 lbs.;



No. 4, 15·3 lbs.; mean of the four, 15·9 lbs. The horse power developed by the engines under the above conditions, the piston moving at the speed of 224 feet per minute, was 1466·28.

---

*Chemistry and Perfumery.**

It will be remembered that Dr. Playfair, in his lecture "On the Chemical Principles involved in the Manufactures of the Great Exhibition," adverts to the fact, that "some of the most delicate perfumes were made by chemical artifice, and not, as of old, by distilling them from flowers." He goes on to state that perfumes thus prepared were sent to the Exhibition, and that "singularly enough they are generally derived from substances of an intensely disgusting odor. A peculiarly fœtid oil, termed 'fusel oil,' is formed in making brandy and whiskey." "Putrid cheese," a "soap made with butter," "the fœtid oils of gas-tar," and "the drainings of cowhouses," are those stated to be the main source to which the manufacturer applies for the production of his most delicate and admired perfumes. Professor Fehling, in the Wurtemburg *Journal of Industry*, gives an abstract of what is at present known respecting the composition of some of these artificial essences. The following is a description of these extracts, and of their manufacture:

Pine Apple Oil.—This product consists of a solution of 1 part of butyric acid ether, in 8 to 10 parts of spirits of wine. For preparing butyric acid ether, pure butyric acid is required, and this is obtained most readily and

* From the Journal of the Society of Arts, London, No. 27.

in greatest quantity, by the fermentation of sugar, or of St. John's bread (*siliqua dulcis*). For preparing butyric acid from sugar, M. Bentch takes a solution of 6 lbs. of sugar and half an ounce of tartaric acid in 26 lbs of water, which is left to stand for some days; at the same time about a quarter of a pound of old decayed cheese is diffused in 8 lbs. of sour milk, from which the cream has been removed; and after this has also stood for some days, it is mixed with the first solution, and the whole is kept from four to six weeks at a temperature of about 24° to 28° Reaumer, water being added from time to time to replace that which is lost by evaporation. After the evolution of gas has entirely ceased, the liquid is dissolved with its own bulk of water, and finally 8 lbs. of crystallized soda, dissolved in 12 lbs. to 16 lbs. of water, are added to it. The liquid is then filtered and evaporated till it weighs only 10 lbs., when a quantity of $5\frac{1}{2}$ lbs. of sulphuric acid (*nordhausen*, or fuming sulphuric acid), diluted with $5\frac{1}{2}$ lbs. of water, is carefully mixed with it by small portions at a time. The butyric acid, in the state of an oily substance, will now appear on the surface of the liquid, from which it may be skimmed off; but as the remaining liquid still contains some butyric acid, it is submitted to distillation, by which means another portion of diluted butyric acid is obtained, which may be concentrated by means of melted chloride of calcium, or by saturating it with carbonate of soda, evaporating and decomposing by sulphuric acid. By this method $1\frac{3}{4}$ lbs. of pure butyric acid are obtained from 6 lbs. of sugar.

M. Marsson says that the same product may be obtained from St. John's bread (*siliqua dulcis*), by taking 4 lbs. of mashed St. John's bread, and mixing it with 10 lbs. of water and 1 lb. of chalk; the liquid matter must be maintained from three to four weeks at a temperature of from 25° to 35° Reaumer, and be often and well stirred, and from time to time the water that has evaporated must be replaced. After fermentation has ceased, a quantity of water equal to the bulk of the liquid is added, and afterwards a concentrated solution of $2\frac{1}{2}$ lbs. or $2\frac{3}{4}$ lbs. of carbonate of soda, when it is finally evaporated. To the concentrated liquid is then added $1\frac{1}{2}$ lbs. to 2 lbs. of sulphuric acid, diluted with 2 lbs. of water; and the remainder of the process is performed as already described. By this method a little more than half a pound of colored butyric acid will be obtained. The acid, however, retains a peculiar smell from the St. John's bread, which continues even in the ether prepared from the same, whereas that prepared from sugar gives an ether of a very pure smell. It will be found advantageous to agitate the oily butyric acid with chloride of calcium, in order to deprive it entirely of its moisture.

For preparing butyric acid ether (butyrate of oxide of ethyle) from butyric acid, 1 lb. of butyric acid is dissolved in 1 lb. of rectified alcohol (95° Tralles), and is mixed with one-half to one-fourth of an ounce of concentrated sulphuric acid; the compound is heated for some minutes, when the butyric acid ether will form a thin layer on the top. The whole is then mixed with half of its bulk of water, and the upper layer taken off; the remaining liquid being submitted to distillation, yields another quantity of butyric acid ether, which is mixed with that obtained in the first instance, and the whole well agitated with a very diluted solution of soda, in order to deprive it of all the acid; which operation should be repeated several

times if a very pure ether is desired to be obtained. Care should be taken to use but small quantities of the diluted soda solution at a time, so as not to lose too much ether, this latter being in some measure soluble in water. When large quantities are to be acted upon, the washing water (*eau de lavage*) is collected, mixed with an equal volume of spirits of wine, and distilled, by which means a solution of pure butyric acid ether in spirits of wine is obtained.

Butyric acid ether may be also obtained immediately from butyric of soda by dissolving 1 part of this salt in 1 part of rectified alcohol, adding 1 part of sulphuric acid, and heating some minutes. The ether collects on the top of the liquid, and is purified by washing with water and with diluted soda solution.

For preparing pine-apple oil, 1 lb. of butyric acid ether is dissolved in 8 lbs. to 10 lbs. of spirits of wine, which should have been previously deprived of its empyreumatic or fusel oil. Pure French spirits of wine will be found best suited for this purpose. According to the purpose for which the pine-apple oil is to be applied, either rectified alcohol of 80° to 90° Tralles, or brandy of 40° to 50°, should be used for dissolving the ether. 20 drops to 25 drops of such an extract will suffice for giving a strong pine-apple odor to 1 lb. of sugar solution, to which some acid, such as tartaric or nitric acid, is generally added.

Bergamot Pear Oil.—What is called pear-oil is an alcoholic solution of acetate of oxide of amyle, and acetate of oxide of ethyle, prepared from potato fusel oil (the hydryte of oxide of amyle). The potato fusel oil, or oil of potato spirits (in German, *fuseloel*), is the compound distilled over towards the end of the first distillation of spirits made from potatoes, and is an oily liquid of a very strong and nauseous odor. This oil, in the state in which it is obtained from large potato brandy distilleries, is never pure; but it may be purified by agitating it with a diluted soda solution, when the pure fusel oil collects as an oily layer on the top of the liquid; this oily substance is then submitted to distillation, and that part which distils over at 100° to 112°, Reaumer, is collected, and forms the pure fusel oil.

For preparing acetate of oxide of amyle from this fusel oil, 1 lb. of pure ice vinegar is mixed with an equal quantity of fusel oil, to which is added half a pound of sulphuric acid; the liquid is digested for some hours at about 100°, when the acetate of oxide of amyle separates, particularly on being mixed with a small quantity of water. The remaining liquid, when mixed with more water, yields, on being submitted to distillation, a further quantity of acetate of oxide of amyle. The entire mass of oxide of amyle thus obtained is now agitated several times with water and a little soda solution, in order to deprive it of all free acid.

The acetate of oxide of amyle may also be obtained by taking 1 part of fusel oil to $1\frac{1}{2}$ parts of dry acetate of soda, or 2 parts of acetate of potash, with 1 to $1\frac{1}{2}$ parts of sulphuric acid. The liquid having been kept for some time at a gentle heat, the acetate of oxide of amyle is separated by adding water, and proceeding as above explained. 15 parts of acetate of oxide of amyle are mixed with $1\frac{1}{2}$ parts of vinegar ether (vinegar naphtha, acetate of oxide ethyle), and dissolved in 100 to 120 parts of spirits of wine, as in the case of pine-apple extract; an acid—for instance,

tartaric or citric, should be added to the sugar solution, on making use of the pear extract, which addition makes the flavor of the bergamot pear better distinguishable, and the taste acquires at the same time more of the refreshing qualities of fruit.

Apple Oil.—What is called apple oil, is a solution of valerianate of oxide of amyle in spirits of wine, which may be obtained as a secondary product when fusel oil is distilled with chromate of potash and sulphuric acid for the preparation of valerianic acid. The light solution which collects in the tops of the distilled liquid contains valerianate of oxide of amyle, together with other liquids, such as adehyde, which gives to the product a less agreeable taste and smell. It is therefore to be preferred for preparing pure valerianate of oxide of amyle.

For preparing valerianic acid, 1 part of fusel oil is mixed by small portions with 3 parts of sulphuric acid, and afterwards 2 parts of water are added. At the same time, a solution of $2\frac{1}{4}$ parts of bichromate of potash in $4\frac{1}{2}$ parts of water is heated in a tubular retort; the first liquid is then permitted to flow very slowly into the liquid of the retort in such manner that the boiling continues but very slowly. The liquid which is distilled over is saturated with carbonate of soda, and is evaporated either to dryness for obtaining valerianate of soda, or to the consistency of syrup, when sulphuric acid is added (say 2 parts of concentrated acid diluted with the same quantity of water, for every 3 parts of crystalline carbonate of soda). The valerianic acid forms an oily layer on the upper part of the liquid, which latter will still yield some valerianic acid on being submitted to distillation. For preparing valerianate of oxide of amyle, 1 part by weight of pure fusel oil is mixed carefully with an equal quantity by weight of common English sulphuric acid; the resulting solution is added to $1\frac{1}{4}$ parts of oily valerianic acid, or to $1\frac{1}{2}$ parts of dry valerianate of soda, and is treated by a water-bath and then mixed with water, by which means the impure valerianate of the oxide of amyle will be separated; this is washed several times with water, afterwards with a solution of carbonate of soda, and finally again with water. In preparing this compound, it is essential that the mixture of sulphuric acid and fusel oil with valerianic acid should not be heated to a too high degree, or too long, as the product would thereby acquire an insufferably pungent smell when required for use. 1 part of valerianate of oxide of amyle is dissolved in 6 or 8 parts of spirits of wine, and acid is added in the same manner, as has been before explained in the preparation of other extracts.

Artificial Oil of Bitter Almonds.—When Mitscherlich, in 1834, discovered nitro-benzole, he little thought, after twenty years, to find this body in an industrial exhibition. He certainly, at that time, pointed out the remarkable resemblance which the odor of nitro-benzole had to that of bitter almonds; but the only sources for obtaining benzole at that time, viz., the oil of compressed gas, and the distillation of benzoic acid, were much too expensive, and put an end to the idea of substituting the use of nitro-benzole for oil of bitter almonds. Mansfield, however, in 1849, showed, by careful investigation, that benzole may be produced easily and in large quantities from oil of coal tar, and this discovery has not been lost sight of in the arts. Among the articles of French perfumery in the Great Exhibition, with the title of *artificial oil of bitter almonds,*

and the fanciful name of *essence of Mirbane*, there were several specimens of oils, which consisted of more or less pure nitro-benzole. The apparatus used in the preparation of this substance is that proposed by Mr. Mansfield. It consists of a large glass worm, the upper end of which branches into two tubes, which are provided with funnels. A stream of concentrated nitric acid flows slowly through one of these funnels, whilst the other is for the benzole (which for this purpose need not be absolutely pure). At the point at which the tubes of the funnels are united, the two bodies come in contact, the chemical compound formed becomes sufficiently cooled in passing through the worm, and only requires to be washed with water, and finally with some weak solution of carbonate of soda, to be ready for use. Although the nitro-benzole closely resembles oil of bitter almonds in physical properties, it possesses, however, a somewhat different odor, readily recognised by a practised person. However, it answers well for scenting soap, and would be extensively applicable for confectionary and for other culinary purposes. For the latter purpose it has the special advantage over oil of bitter almonds, that it contains no prussic acid.

The American Annual of Scientific Discovery, speaking on this subject, says, "The composition and artificial production of the various extracts of fruit and other similar perfumes and essences, strikingly illustrates the wonderful progress which has been made in organic chemistry within the last few years. A position has been taken by some chemists who have carefully investigated this subject, which cannot at present be controverted, that the extracts or perfumes of the various fruits which can be artificially prepared in our laboratories from the basic organic radicals, are identical, and the same with those which nature carefully elaborates in the apple, the pear, the pine-apple, banana, and the like. The whole subject has been investigated more carefully, and has been applied to more practical purposes than the public is generally aware of. Take, for instance, the well known perfumes known as 'Lublin's Extracts,' extract of geranium, millefleurs, new-mown hay, and many others; all of these are said to be prepared from two or three of the common and cheap essential oils, and from the organic radicals. In addition to perfumes the most agreeable, odors of the most disgusting and nauseous character can also be produced by like means; as for instance the odor of the bed-bug, squash-bug, and of many of the weeds and plants. As an odor and perfume of a different character can be produced by the action of each different acid on the different oxides of the organic radicals, the number of bodies of this character capable of being produced is almost innumerable, and may possibly embrace every known odor or perfume which is now recognised in the animal, vegetable, or mineral kingdom.

"The various artificial extracts of fruit have been applied to the flavoring of an agreeable species of confectionary known as the 'acidulated fruit drops.' These have been denounced as poisonous by some persons on the ground that fusel oil is known to produce deleterious effects; and as a natural consequence the confectionary referred to has been discarded. There is, however, no foundation for such statements or belief; and if the confectionary flavored with these extracts has in any case produced injurious effects, it is undoubtedly to be referred to an injudicious consumption of it, and not to any inherent deleterious property."

Translated for the Journal of the Franklin Institute.

Rolled Sheets of Bitumen.

MM. Aumeteyer believe that they have made a valuable improvement in the use of bitumens, by submitting them to rolling. The bitumens, say they, have been proved as to their qualities and endurance; their water-repelling properties and impermeability cause them to be more and more sought for every day; but up to the present time, no one had thought of rolling them out, and reducing them to thin sheets, easily to be laid when cold, like zinc and lead. This new mode of treatment does away, in the first place, with the inconveniences of melting on the spot, which is so disagreeable; and it gives to the bitumens, besides, a density and solidity which they have not yet attained; it assures them an indefinite durability.

Thus prepared, bitumen will very advantageously replace slate, zinc, lead, thatch, &c., as coverings for terraces, buildings, &c. It melts, but does not inflame; and would rather extinguish than nourish combustion. They are incomparably lighter even than slates, and are non-conductors both of heat and electricity; they cost less even than thatch, require no attention, and are in no way affected by atmospheric influences; they are impermeable to water, &c., &c. They will be of great service in rendering damp places healthy; they are applied without difficulty to walls, and adhere strongly; a cellar whose walls were covered with rolled bitumen or asphalte, would be as healthy and as habitable as the upper story, provided light finds access, and the air is sufficiently renewed. In water-conduits, reservoirs, basins, baths, washing establishments, and silos for the preservation of grains and vegetables, these sheets of bitumen, so thin, yet as unalterable as metals, will be of immense service. Easily painted, they may be employed either for wall-hanging or for floors.

Cosmos, 21st October, 1853.

An Improved Material applicable to many purposes for which Papier Maché and Gutta Percha have been or may be used. Patented by Peter Warren, October 12, 1852.*

This invention consists in manufacturing a new material or composition of a character analogous to papier maché, which is capable of being employed either as a substitute for papier maché or gutta percha, and its compounds, in forming or manufacturing various articles for which these substances are now used, such as panels and mouldings for railway carriages, trays, picture and other frames, door knobs, buttons, &c., by treating the straw of any fibrous vegetable material in the manner hereinafter described. In order to carry out this invention, straw of any fibrous vegetable substances, such as wheat, barley, oats, rye, and other similar straws, are cut into short lengths, by means of any suitable cutting machine. When these straws have any knots, it is necessary to open out and divide the same, which is effected by passing the straw through a pair of millstones, or between crushing rollers; or they may be submitted to the action of any other equivalent apparatus, so that the knots and

* From the London Repertory of Patent Inventions, Sept. 1853.

fibres may be thoroughly and effectually separated and divided. In some cases, either hot or cold water, or other liquid is applied to the materials under operation, in order to facilitate their process. The cut and divided straw is then boiled in a strong alkaline ley, or solution of caustic alkali, such as soda, potash, &c., until a pulpy mass is produced,—which effect will, however, greatly depend on the nature of the straw operated on, and the strength of the alkaline ley, or solution which is employed. The mass is then transferred to the machine known in the paper making trade as the rag engine, where it is reduced to pulp, in the manner usually practised when operating on rags, &c., in the manufacture of paper. The pulp is then partially dried; in which state it may be pressed or rolled into sheets, or moulded into other forms. These sheets or moulded articles are then dipped into oleaginous or glutinous matter, or oil, and are afterwards baked in an oven similar to that employed when manufacturing sheets or moulded articles of papier maché. The sheets or moulded articles, thus formed or manufactured, may be ornamented in any desired manner, either by japaning, or painting and varnishing, or by inlaying the surface with shell, or other analogous material, as is commonly practised in the ornamenting of articles composed of papier maché and gutta percha. When the sheets or moulded articles are required to be colored, pigments or coloring matter might be introduced into the pulp while in the rag engine; the subsequent processes of drying, rolling, pressing, or moulding, being performed as previously described.

The patentee claims the manufacture of a material which may be used as a substitute for papier maché, and for many purposes to which papier maché and gutta percha have been or may be employed, from straw pulp submitted to pressure, and then oiled and baked as hereinbefore described.

For the Journal of the Franklin Institute.

A Visit to the Gap Mine of Lancaster County.

This mine is situated about four and a-half miles from Christiana, in the County of Lancaster. It was first worked in the year 1732, and subsequently wrought again by a company in the year 1797. The only particulars now known relating to those operations may be seen in a pamphlet in the Philadelphia Library, No. 9125, from which it appears that the produce at that time was copperas and precipitate of copper, from the vitriolic water which issued from the veins. At that period the veins were not explored to any considerable extent, and the work chiefly consisted of surface explorations, although they succeeded by the aid of the imperfect machinery they then had, in sinking a shaft to the depth of from sixty to eighty feet; but the water was such an impediment, that the veins could not be pursued at that depth. Latterly these mines have been purchased by a company of gentlemen of the city of Philadelphia, who have a charter from the Legislature under the title of the Gap Mining Company. They have erected a steam engine on the works, and sunk the original shaft to the depth of 100 feet, from which a gallery is extended some 200 or 300 feet. They have also extended the old works at a depth of 60 feet, and sunk several shafts to

determine the extent of the veins, for there appears to be several veins running parallel to one another, and one vein running transverse to these parallel veins. These veins are all from 10 to 15 feet wide, producing copper and other ores; but as they sink deeper, it changes into nickel and cobalt ores, of which there appears to be an inexhaustible supply. These ores contain by analysis:—

Sulphur,	27·67
Iron,	48·41
Nickel,	5·67
Alumina,	1·40
Silica,	16·85
	100·00

They are now being taken to Philadelphia to be smelted. There are some hundreds of tons now lying on the surface, and some thousands of tons discovered in the mine, and extensive preparations are being made for working the mine on a large scale. L. T.

For the Journal of the Franklin Institute.

Particulars of the Steamer Yankee Blade.

Hull built by Thomas Stack, Williamsburgh, New York; machinery by the Allaire Works, New York. Intended service, New York to Aspinwall.

Hull.—	
Length on deck,	275 feet.
Breadth of beam at midship section,	38 " 8 inches.
Depth of hold,	30 "
Length of engine and boiler space,	82 "
Draft of water at load line,	13 "
Floor timbers at throats, moulded,	16 inches.
Do. do., sided,	12 "
Distance of frames apart at centres,	24 "
Masts and rig,	Three masted, foretopsail schooner.
Tonnage,	2290 tons.
Engines.—Two vertical beam.	
Diameter of cylinder,	6 feet 3 inches.
Length of stroke,	11 "
Boilers.—Two, return flued.	
Length of boilers,	31 feet 9 inches.
Breadth "	13 "
Height " exclusive of steam chimney,	11 " 10 "
Number of furnaces,	12
Length of grate bars,	7 " 6 "
Diameter of smoke pipe,	6 " 4 "
Height of smoke pipe,	66 "
Description of coal,	Anthracite.
Water Wheels.—	
Diameter,	32 feet.
Length of blades,	8 " 6 inches.
Depth "	1 " 6 "
Number of blades,	28

Remarks.—Hull strapped with diagonal and double laid iron straps, $4 \times \frac{5}{8}$ inch; floors are filled in solid.

For the Journal of the Franklin Institute.

Particulars of the British Steamer Curlew.

Hull built by Wm. Denny & Brothers, Dumbarton; machinery by Tullock & Denny, Dumbarton. Intended service, New York to St. Thomas.

Hull.—	
Length on deck from fore part of stem to after part of stern post above the spar deck,	180 feet.
Breadth of beam at midship section above the main wales,	25 "
Depth of hold,	14 " 6 inches.
Draft of water at load line,	14 "
Frame, shape and dimensions,	⅂L $4 \times 3 \times \frac{3}{8}$
Do., distance apart at centre,	15 "
Keelson,	16 inches deep.
Masts and rig,	Three masted foretopsail schooner.
Engines.—Vertical direct.	
Diameter of cylinders,—Two of	36 inches
Length of stroke,	3 feet.
Maximum revolutions per minute,	60
Boiler.—Tubular.	
Maximum pressure of steam in pounds,	60
Plates, thickness,	$\frac{5}{8}$ and $\frac{1}{2}$ inch.
Description of coal,	Bituminous.
Screw.—	
Diameter of screw,	12 feet.
Number of blades,	Three.

Remarks.—Poop deck; five water-tight bulk heads; single riveted, $\frac{5}{8}$ inch rivets, $2\frac{1}{2}$ inches apart. Clincher built and abut riveted.

For the Journal of the Franklin Institute.

A Visit to the Lead and Copper Mines of Chester County, Pennsylvania.

By L. Turnbull, M. D., Lecturer on Chemistry.

Within a mile of each other, in the vicinity of the beautiful stream called Pickering Creek, these lead mines are situated; but I was sorry to find that they added nothing to the comfort of the farmer in whose region they were placed, for upon inquiry I was informed that every spring in their vicinity was entirley dried up, and that even the Railroad Company's supply has entirely failed. This should always be provided for by a special agreement by the farmer on whose land they operate, for it is a very serious evil to find that his spring house is no longer fitted for the storing of milk, cream, and butter.

The first mine which I visited is called the *Charleston Mine*, and is situated on the farm of Capt. Davis; it has been in operation about fifteen months, and the product is exclusively lead ore; the salts of lead are the sulphuret or galena carbonate and phosphates of lead. They have sunk a shaft of 180 feet. The vein is about two feet wide, but is apt to be filled up in many places with inferior deposit, containing very little

true lead ore. This mine is owned by a company of capitalists of Philadelphia, under the superintendence of Mr. Charles Wheatley; the chief miner, or captain of the mine, is Mr. W. Perry. To keep the mine free from water, they have in operation a beautiful Cornish whim or low pressure condensing engine, of 60 horse power, built by Mr. John West, of Norristown. In this form of engine there is a great saving of fuel; it is arranged so as to set a crushing machine in operation. They have also a horse whim and capstan, and out-house containing two giggin machines. The price given to the miner is from 30 to 35 dollars a month; above ground, they had a man and a boy; in the mine, they had 8 or 10 miners at work. But this mine has yielded but a few tons of ore, and the prospect is far from being good, being an outlay without any return.

After crossing the creek a second time, and ascending the hill about a quarter of a mile, at the corner of the wood I came to the Montgomery Company's Mine, which, before entering, presented an active spirit of industry, very different from the quiet of the Charlestown Mine, there being some four or five men, with several boys, at work above ground; the puff of the steam also causing it to be seen at a considerable distance. Upon inquiring for the Captain, I found him to be an agreeable, intelligent man, whose name was McGerk.

This mine has only been in operation for about 12 months, and has sunk a shaft some 120 feet; the encouragement to progress has been very good, the ore is abundant; but they have been considerably annoyed with the large quantity of zinc ore, which has to be separated by washing; they had some 4 or 5 tons on hand. They have a small horizontal high pressure engine at work, and the horse whim was in active operation, dragging up ore, which is principally galena and phosphate of lead. They had some 15 miners at work, and one of them was complaining of the want of proper ventilation in the mine, so that their lamp or candle would not burn, and they had to come up after each blast to get rid of the smoke; this I have found a great defect in most of the mines that I have visited, and some endeavor should be made to obviate it.

The third mine visited, being about half a mile from the Montgomery Mine, is called Sherwood's, but every thing about the mine looks desolate; as all operations have been stopped for several months; the iron work is rusting; the only miner at work was a Cornish man, who, with a little boy, was washing carefully with a buddle the refuse washings of former operations; he was making about a ton of ore, with much care, in about two weeks, yielding 60 per cent.; this, he said, was poor work, as they only gave him 15 dollars a ton for it. He had been a washer of ores in Cornwall, and his father before him, commencing at the age of eight years; but he was very desirous of getting to Mineral Point, where he had two uncles; he said he should then feel as if he were at home in one sense.

I then passed over into Mr. Sherwood's smelting house, where he produces about fifty to fifty-five tons of lead from every hundred pounds of rich ore, and if the ore is galena they then can extract from twenty-five to thirty-seven ounces of silver from the ton of metallic lead by cupellation. They I find are erecting the brick work for a series of boilers, so as to go into operation and extract the silver by the new process of Pattenson, by

taking advantage of the crystallization of the lead, so as to remove it, and leave the lead with a large quantity of silver, and by cupellation there is less of lead oxidized and fewer of the cupels employed. The chemist's name is Mr. W. Johnston.

The fourth mine is situated on Funks' place; their shaft has been sunk some ninety feet, and they are about increasing the depth, there being some little encouragement to do so; they have also a steam engine in active operation; this mine has only been open within the year 1852.

Across a single field is situated the Wheatley Mine, the deepest lead mine in this region, being some two hundred feet, with levels run in several directions. The old or first shaft is employed for raising refuse matter but at the shaft back of the blacksmith's shop they are raising ore. There are some four shafts at different points, and the ore is the same as that found at the Charlestown mine. In Mr Wheatley's collection of ores of lead from this mine, there are two varieties of galenas, fibrous, and steel grained, the latter being richer in silver than the former; there are also phosphates, chromo-molybdinate, with beautiful crystals of sulphate, in the centre of geodes of galena; also, fine specimens of carbonate. They have a large bucket wheel driven by water, which driving two large iron wheels crushes the ore; the number of men and boys employed in washing and sorting being greater than at any other of the mines in that region. They are also digging all over the fields in the immediate vicinity for ore; their steam engine is high pressure, and the prospects of this mine are stated to be good, but of the amount of ore raised, cost of raising, &c., I could not find any account, although I desired the information. Having spent some time at this mine, I started for the copper mine on Judge Morris's beautiful farm, which is situated about two miles from Wheatley's mine, and a quarter of a mile south of Phœnixville, a square off from the state road, in a grove of trees. The mine is owned by a New York company, who commenced working last summer (1853), and brought out a good deal of ore but found that the steam engine employed by them was too small, the water having increased so much; they are now erecting one of one hunded and eighty horse power, with a fly wheel twenty-five feet in diameter, in a very substantial manner. The vein of sulphuret and carbonate of copper runs in an easterly direction, directly under the Judge's house, and varies from eighteen inches to four feet; they have upon the ground some twenty or thirty tons of ore, which, as far as I could judge, was not very rich, but still if they have an abundance of it, there will be no doubt it will pay, at the present prices of copper ore in the market. The owners, workmen, and the persons around the works, speak in the highest terms of the encouraging prospect of the mine; still I do not consider the ore as rich as that of the Perkiomen Mining Company, but the expense of raising the ore will be much less.

---

*Remarks on Improvements in Paving—Granite or Wood.**

Messrs. Perkes & Co., the engineers, of Walbrook, have recently patented, and submitted for public patronage, a novel system of construc-

* From the London Mining Journal, No. 946.

tion for the pavement of roads, bridges, &c. Proceeding on the principle that the inequalities in the best of pavements are first caused by the partial collapse or sinking of the foundation, or sub-strata, they have, to a certain extent, rendered the finished portion of the road independent of the homogeniety and solidity of the concrete beneath. The plan consists in casting in sections of 3 feet square a series of iron boxes, beds, or chambers, 8 inches long, 3 inches broad, and 4 inches deep, into each of which a block of wood is placed, with the grain in a vertical position, or a block of granite, made to fit with moderate exactness, and standing about 2 inches above the iron framework. By this arrangement, the total number of sections being made to break joint, and firmly keyed together, gives great solidity, avoids all tendency to partial sinking in holes, secures a good foothold for the horse, whether gravel is used as an upper coating or not, and as one or more blocks, more soft than others, show signs of wear or decay, they may be instantly, and with great facility, replaced by others. Another peculiar feature may be noticed, which will prove a source of economy; it is proposed to make the compartments for streets of greatest thoroughfare the deepest, for secondary streets perhaps $1\frac{1}{2}$ inches less in depth, and for those of third class traffic more shallow still. By these means, when the blocks are so worn as to require removal in a first class street, they may be removed to a second class, and from thence again to a third, thus getting the utmost possible utility out of the material employed. It will be noticed that either wood or stone can be employed; but as a wood pavement, combining economy with non-slipperiness, is a great desideratum, we would suggest that the patentees should obtain permission to lay down a piece as a specimen, composed of wood, with the grain vertical, in some moderately crowded carriage thoroughfare, and thus give the invention a somewhat severe test, by which its real merits might be appreciated.

On the Application of Air Chambers to Pump Suction Pipes. By W. Baddeley, Esq.*

In the "Report of the Juries," Exhibition, 1851, at page 178, there appear the following remarks, by the Rev. H. Moseley, reporter to Class V., upon the subject in question:

"A remedy for some of the evils (previously enumerated) in the working of a pump has been sought in the application to it of a second† air vessel, communicating with the suction pipe immediately below the barrel, or with the top of the suction pipe and the bottom of the barrel. The commencement of each stroke is eased by a supply of water from this air chamber to the space beneath‡ it. The influx of the water into that space is aided by the pressure of the condensed§ air in the air chamber, and when the stroke is completed, the state of condensation of this air (?) is, by the momentum of the water in the suction pipe, restored, causing it

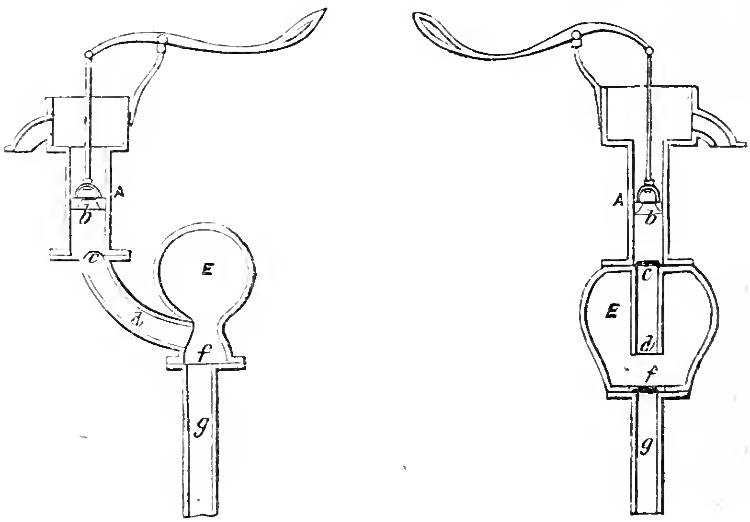
*From the London Mechanic's Magazine, November, 1853.

†There may be, and usually is, no first.—W. B.

‡It may be above.—W B.

§There can be no condensed air in that arrangement.

to rush through the passage by which that pipe communicates with the air chamber. Thus, by this contrivance, the surplus work, or half the *vis viva*, which remains in the water of the suction pipe at the conclusion of each stroke, is stored up in the compressed air of the air chamber, and helps to begin the next stroke of the piston. The suction air chamber has been added to a common suction pipe, exhibited by Mr. Self, in the agricultural department, where, being made of glass, its action was readily to be seen. It is also introduced in a class of small pumps, called 'fire-syringes,' exhibited by Mr. Baddeley,* and Messrs. Shand and Mason.† Except in the case of the Canadian engine, it does not, however, appear to have been applied to any of the larger class of engines exhibited.‡ 'It should probably be constructed of much larger dimensions than have been given to it in either of these engines!!!' When the high character of the jurors, and the well known talents of their reporter is considered, it is a matter of unfeigned regret that the report upon the highly important subjects contained in Class V. of the Great Exhibition should have been so meagre in its character, and display throughout such an evident want of care in its preparation. Sins of omission and of commission abound. Of five exhibitors, honorable mention is made in the body of the Report (page 179); but not being included in the tabular list of awards, no publication of the fact ever took place, as in other classes, nor were these exhibitors aware of the distinction intended to be conveyed until they received a copy of the 'Juries' Report,' long after the Exhibition closed!



Herewith I send two sketches of common suction pumps, fitted with an air vessel upon the feed pipe. A is the pump barrel; *b* the bucket; *c*

* Described in *Mech. Mag.*, vol. liv., p. 390.

† Described in *Mech. Mag.*, vol. lii., p. 290. But in neither of these contrivances is any suction chamber employed!

‡ Another notable mistake.

the lower pump valve; *d* the pipe leading to the air chamber E; *f* is a second valve on the upper part of the pipe *g*. We may suppose the difference between the two water levels (that is, in the well and the pump) to be about 20 feet. When the pump is first worked, its operation will be to partially exhaust or rarefy the air in all the passages between the pump bucket and the water, until it is about one-third of its original density; say equal to a pressure of about 5 lbs. upon the square inch. As this point is approached, the water rises to the pump, occupying the whole of the passages, *g*, *d*, and A, and a portion (about two-thirds) of the air chamber E, its upper part being occupied by rarefied air of the density before stated. If the relative proportions of the pump and feed pipe, and the speed at which it is worked, are such that the power expended at every stroke is just sufficient to bring the water raised to rest at the end of each stroke, no practical benefit will result from the employment of the air vessel. But if the dimensions of the pump barrel and feed pipe differ considerably, and the pump is worked so fast as to produce a considerable initial velocity of the water in the feed pipe, then the air chamber comes into useful operation. The *vis viva* (momentum)* of the water will cause it to rush into the air chamber E, increasing relatively the density of the air, but never, or rarely, reaching atmospheric equilibrium, much less condensation. On again raising the pump bucket and exhausting the barrel, a portion of the water is drawn from the air chamber E, and the air above it attenuated, when the column of water in the feed pipe *g*, is set in motion, supplying the requirement of the pump barrel and expending its *vis viva* in a surplus supply to the air chamber, and so on continuously. "The nature of this action," says the writer before quoted, "will be best understood from that of the hydraulic ram. The contrivance constitutes indeed, in some respects, a union of the action of the ram with that of the pump; and, besides accomplishing the object for which it was applied, appears to have the effect of considerably economizing the power employed in working pumps." The difference is, that in the suction air chamber the air is rarefied, that is, less than atmospheric pressure; whereas, in the hydraulic ram, the air is in a state of condensation considerably greater than atmospheric pressure.

In the case of the fire-engine from Canada, the jurors commend "the large proportion of the sectional area of the suction pipe to that of the barrel;" as also "the application of an air chamber to the suction pipe," which the large proportion of the former rendered needless, and the absence of a valve rendered inoperative. The same remark is applicable to another engine exhibited, but not specially noticed in the Report.

13, *Angell-terrace, Islington, Nov.* 9, 1853.

Iron Ships struck by Lightning. By W. SNOW HARRIS.†

It having been asserted that there is no record of iron ships having been struck by lightning, although they have been in all climates, Mr. W. Snow Harris writes—"This is, I beg to say, a great misapprehension. Her Majesty's ships *Bloodhound* and *Jackall*, both built of iron, were

* [*Vis viva* and momentum are not equivalent terms.—ED. M. M.]

† From the London Mining Journal, No. 948.

struck by lightning off Lagos—the *Bloodhound* in Oct. 1851, and the *Jackall* in Sept. 1852. The damage was considerable. The *Bloodhound* had her foretopgallant-mast and topmast shivered, and her sails burned. The *Jackall* also had her foretop-mast shivered, and other damage. I venture to call attention to these facts, lest an erroneous, and perhaps unfortunate, impression may arise in the public mind relative to the immunity of iron ships from the effects of lightning. As I never venture on any opinion connected with this subject which I cannot support by facts, I beg to refer for further information to the logs, &c., of those vessels deposited at the Admiralty. The fact is that an iron ship is just as likely to be struck by lightning as any other ship, although little damage would arise to the hull or shell of the vessel when the electrical discharge had fairly reached it. We must, however, be prepared to encounter the same amount of danger in all the imperfect conducting substances intermediate between the masts and shell of the vessel as we find occurring in ships of wood, supposing the ship had no regular fixed conductor. I beg permission also to correct another misapprehension which appears to have arisen relative to steam-ships. The *New York Tribune* has an article on ships damaged by lightning, from which the public may be led to conclude that no steam-vessel is liable to damage from the electrical discharge; and this I have found repeated in other quarters. Now, to show the fallacy of such an opinion, it will be sufficient to refer to the logs of her Majesty's steam-ships *Blazer*, *Gorgon*, and *Rhadamanthus*, as also to several cases in the West India and Oriental Company's steam mail ships, all of which have been struck by lightning, and considerable damage ensued. In her Majesty's steam ship *Blazer*, struck by the electrical discharge, on 20th March, 1839, in the Mediterranean, 30 feet of the sponsons were blown out, all the iron stanchions started, the maintopgallant-mast shivered in pieces, mainmast damaged, rigging set on fire, cabin filled with smoke, the chain haulyards knocked in pieces, so that the links strewed the decks; two persons were struck down and nearly killed. The idea, therefore, of the security of life from lightning in such ships is quite a mistake. I have ventured on these remarks solely with a view of correcting a false impression, which might lead to ill consequences to the public interest, and in a purely philosophical spirit.

Windsor Villas, Plymouth, Oct. 19.

To Find the Strength of Wrought Iron Plate Girders. By E. W. Tarn.*

In a former paper on this subject (p. 646,) we showed how a formula might be obtained for calculating the weight which may be safely laid on a girder; we will now further elucidate the subject by applying the formula to a few examples.

The equation which we obtained was as follows:—

$$w = \frac{4f \times (\mathrm{CN})^2 \times (2t \times \mathrm{AB} + \frac{2}{3}s \times \mathrm{CN} + 4a)}{l}$$

f being found from the equation, $f \times \mathrm{CN} = 8$ tons. It must be ob-

* From the London Builder, No. 561.

served that f is not a constant, but varies with the depth of the girder so as to make $f \times$ CN a constant.

This value of w can be simplified by substituting for f its value, and the formula then becomes, $w = \frac{32 \times CN \times (2t \times AB + \frac{2}{3}s \times CN + 4s)}{l}$ w being the weight in tons which may be safely laid on the centre of the girder, and $2\,w$ is the weight which may be safely distributed over the whole length.

Example 1.—Let CN $= 6$ in. AB$=5$ in. $l = 10$ ft. $= 120$ in. $s = \frac{1}{2}$ in. $t = \frac{1}{2}$ in. $a = 1$ square inch; then $w = \frac{32 \times 6 \times (5 + 2 + 4)}{120} = 17{\cdot}6$ tons, or the girder will safely bear $17\frac{1}{2}$ tons laid on the centre, and 35 tons distributed over the whole length.

Example 2.—Let the length of the girder be double that of the last, all the other dimensions remaining the same, then $l = 20$ feet $= 240$ ins., $w = \frac{32 \times 6 \times (5 + 2 + 4)}{240} = 8{\cdot}8$ tons, or the strength is half that of the former example.

Example 3.—Let the depth be doubled, all the other dimensions remaining the same as in the last example; then CN$=12$ inches, $w = \frac{32 \times 12 \times (5 + 4 + 4)}{240} = 20{\cdot}8$ tons, which shows how much more strength is gained by increasing the depth than by increasing any other dimension, a principle which holds in beams of every description.

For the benefit of those readers who are unable to interpret an algebraical expression, we will express the value of w in words, and thereby enable any persons who are only acquainted with the first four rules of arithmetic to apply this formula for themselves.

1. Multiply the width AB in inches by twice its thickness.
2. Multiply the half depth CN in inches by two-thirds of its thickness.
3. Multiply the area of section of one of the angle irons in square inches by 4.
4. Add together all the preceding results, and multiply the number thus obtained by 32 times the depth CN in inches.
5. Divide this last result by the length of the girder in inches, and this gives the weight in tons which may be safely suspended from the middle of the girder.

---

*Petition to the Privy Council against the use of Stage Coaches.**

The following minutes of proceedings, "At the Court at Whitehall, the 20th of November, 1672; present, the King's Most Excellent Ma^{ty}" &c. extracted from the "Council Register" (ch. ii. vol. x. p. 337), and for which we are indebted to Mr. Robert Lemon, are very instructive and curious, showing as they do how ignorance and personal interest have ever fought against improvement and progress:—

* From the London Builder, No. 564.

"The humble petition of ye masters and wardens and governors of ye severall companys of sadlers, cutlers, girdlers, cordwayners, curriers, loryners, inholders, farriers, spurriers, and watermen of the Citty of London, presented with the approbation and by the consent of the Lord Mayor and Court of Aldermen of the said Citty, on behalf of themselves and ye rest of ye members of the aforesaid severall companys, and divers other tradesmen and hackney coachmen, in the Cittys of London and Westminster, the burrough of Southwarke, and countys of Midd^{x} and Surrey, and other places within this Kingdome, being this day read at the boord, and there being at the same time likewise presented severall petitions from the cittys of Norwich, New Sarum, Bristoll, and Glocester, and from ye townes of Northampton, Daventry, Marleborough, St. Alban's, Maidenhead, Staynes, and Theale, All setting forth, that by reason of the many running stage coaches and carravans of late yeares set up, for carrying passengers to almost all places within this kingdome, not only pet^{rs} trades are lost, and above 100,000 familys reduced to beggery already, and many thousands more like suddenly to fall upon ye severall parishes wherein they dwell, for maintenance, but many other great mischeifes to this Kingdome are occasioned, for by them ye roads are spoyled, the rents of all inns lessened, inholders made unable to pay their rents and dutys, or to provide fit accomodation for their guest, or to releive the poor, as formerly they were wont to do, the consumption of all sorts of provisions for man and beast are prevented, the rents of gentlemen's estates brought downe, the breed of good horses destroyed, the keeping of great numbers of horses, both in ye Citty by merchants and others, and in the country and all great townes of England, is left off, which hinders ye consumption of vast quantitys of horsemeat; the breeding of many thousands of watermen hath been hindred, and those that are bred are greatly hurt and discouraged by them; his Ma^{es} subjects, unused to riding, are growne carelesse of attayning to good horsemanship, a thing so necessary for them to understand, in order to their owne and ye kingdomes service; the consumption of woolen, leather, and other manufactories of ye kingdome, are greatly lessened, whereby, the handicraft tradesmen aforesaid, who formerly lived well, helped to consume provisions, and releive others, are for want of worke ready to starve. They ruine the hackney coachmen in London, who are licensed and pay five pounds pr ann: for their license, and do greatly annoy and breake the streets, without paying anything towards reparation. The revenue of excise and Post-office is much abated, the kingdome is weakened, and the subjects are made unfit for his Ma^{es} service, and, therefore, praying the said coaches may be suppressed, or such order speedily taken therein as shall be thought most conducing to the good of his Ma^{tes} subjects.

It was ordered by his Ma^{ty} in Councill, that the matter of these petitions be taken into consideration at this boord on Wensday, the 4th of December next; whereof the pet^{rs} are to cause timely notice to be given to as many of ye chief owners of ye hackney stage coaches and carravans that travell ye northerne, westerne, and other great roads of this kingdome, as they conveniently can; and that ye said keepers of coaches and carravans, as also some person or persons appointed by the pet^{rs}, do give

their attendance at ye time and place aforesaid; and it was further ordered that both partys have liberty to bring with them councill learned if they please."

---

*On the Progress and Present State of the Electric Telegraphs.**

The explanation which we gave in our last Journal of the remarkable improvements in the electric telegraph has attracted very general attention, and the prospectus of the Universal Electric Telegraph Company is now before the public, under a highly influential directory. As the subject is one of intense scientific interest, as well as of great national importance, we this day devote our columns to a further elucidation of the progress and present state of that art. The electric telegraphs at present in operation may be divided into four classes—First, those the pointers or indices of which move in front of dials by the agency of the electric current inside or beneath them. Second, those the indications of which are marked by the breaking up of a continuous line, and dividing it into short and long lines and spaces. Third, telegraphs showing letters, in which a pointer on a dial is made, by the agency of electricity beneath or behind the dial, to give motion to a wheel governed by an escapement, and then to a hand in front of the dial. Fourth, letter or type-printing telegraphs, in which the letter or metallic type is brought to a position, and while there made to impinge on paper, or otherwise to give the impression.

In the first class may be placed Cooke's and Wheatstone's telegraph, as used by the Electric Telegraph Company; Highton's, as used by the British Telegraph Company; Henley's and Foster's, as used by the Irish Magnetic Telegraph Company; Deering's, as used by the Submarine and European Telegraph Company; and Allen's, as proposed to be used by the United Kingdom Telegraph Company. The second class embraces Bain's Telegraph, as used by the General Telegraph Company on a few of their principal lines, the paper on which the line is made being in this plan saturated with a metallic solution; and Morse's, used in America, in which plain paper is employed, and which is now introduced by the British Telegraph Company on some of their lines, in preference to the pointer telegraph of Highton, previously referred to. To these may be added Bakewell's copying telegraph, which, by a series of broken lines placed one under the other, leaves the letter indicated, or rather omitted, by the spaces in the broken lines. In the third class may be placed Wheatstone's original telegraph, now belonging to the Electric Telegraph Company; Highton's, to the British Telegraph Company; Gamble and Nott's, to the Electric Telegraph Company; Allen's, proposed to be used by the United Kingdom Telegraph Company; and others of less note. The dial system is, however, subject to this objection, that when the hand is standing at O, or what ought to be the starting point, it must, in order to spell a word, traverse or pass over other letters on the dial, varying in distance according to the position of the word in the alphabet, and this it must do in spelling every word. Under

* From the London Railway and Commercial Gazette, No. 952.

the fourth class, the letter or type-printing telegraphs, must be classed Brett's telegraph, belonging to the Submarine Telegraph Company, and House's, as in use in America.

The advantages of the new telegraph now proposed to be worked by the Universal Electric Telegraph Company over the telegraphs comprised in the first class are, that the signals or indications corresponding with the movement of the needles or pointers are made and marked legibly and distinctly, so rapidly that needles or pointers moving at the same rate could not be read by the most experienced operator. To this must, of course, be added the incalculable advantage of having the communication fixed and recorded on paper, instead of the mere flickering and fleeting movements of pointers. In the first instance, the operation may be carried on with a rapidity never contemplated in former telegraphs; and in the second instance, the communication is permanent, and may be kept and proved in years after, like a short-hand writer's note, by any person master of the alphabet. A further marked superiority consists in this—that in all telegraphs worked on the principle of the first class, one operator is required in the first instance to read the motions of the pointers, and another at the same time to write them down. In the new telegraph only one operator will be required, who will write down the several communications as they appear on the paper before him, and at the same time; and thus there is a saving of one-half of the staff of operators.

Telegraphs of the second class presented certain advantages—namely, rapidity, simplicity, and clearness of character. Bain's telegraph consisted of an iron pointer or stilus, pressed upon paper saturated and kept moist with a metallic solution. Marks are made upon the paper by the passage of the electric current from any distance through the stilus, and consequently through paper in its passage to the earth, acting upon or decomposing both the iron stilus and the solution on the paper, and leaving after it a dark mark. By this system it is evident that if the current is continuous through the wire, and the paper be drawn regularly under the stilus, the result will be a dark line; and if the current be passed irregularly and in pulsations, the line will be broken; and when the current ceases to pass along the wire, no mark whatever will appear. The principle of Morse's telegraph is nearly similar; but instead of a metallic pointer acting chemically, and being in its turn chemically acted upon, this invention is a mechanical telegraph, giving precisely similar results. A lever is used, being depressed at one end and raised at the other, while the current is passing through a magnet at one extremity. A pin is placed at the raised end of the lever, which scratches the paper on contact, while the current is passing, and the paper moving under the pin end of the lever. If the current is passing in pulsations, the line is of course broken; and when the current ceases to pass through the magnet, the line also ceases to appear. The only form of cipher or character which these telegraphs can represent is short or long lines—thus one short line may be called *a*, two short lines *b*, three short lines *c*, one long line D, two E, three F, so that to obtain 30 letters or conventional signs, a greater number of long or short lines, or of both, have to be used. Increased rapidity will be secured by the new telegraph from the circum-

stance, that instead of one short pulsation or dot, representing one letter, it will represent two letters, two will represent four, and so on ; and the same with continuous lines, so that with one, two, and three short pulsations, and one, two, and three long pulsations, instead of making, as in Morse and Bain's telegraphs, only six signs or letters, twenty-eight or more can be made, thus exceeding the whole alphabet. It is evident, therefore, that instead of seeking other and longer combinations, as must be the case with the other telegraphs, the new company will be enabled to make all necessary combinations with the newly invented telegraph. Simplicity is secured by the new telegraph using paper that does not require any preparation, either chemical or mechanical, and that is only one-fourth of the expense of that required for Morse's telegraph.

Clearness is obtained by the length and size of the distinguishing characters ; for instance, one short pulsation of either Morse's or Bain's telegraph makes a dot or short line of about one-sixteenth of an inch long. In the new telegraph, a similar pulsation will make a character resembling a V, or angular or arrow-pointed form, having a base about the same length as the short line above specified, and a depth in the sides of an eighth of an inch, being therefore much more distinct. Another superiority, known chiefly or only to telegraphers themselves, exists ; for in consequence of the characters presenting a continuous line, and there being only sufficient distinguishing space left between them, they are not subject to the same defects, or likely to be read wrong, as constantly occurs in other telegraphs.

No comparison need be made with the third class: they are admitted to be so inferior to telegraphs of the first and second class; depending on an irregular vibrating movement, the slightest casual irregularity or fluctuation entails the certainty of mistake in the entire word or message.

The advantages of the improved system over telegraphs of the fourth class are numerous. Although the public are apt to be attracted and misled by the supposed benefits to be derived from the telegraphs printing the letters in Roman and other readable type, there are more imperfections attending this class than are generally supposed, and which are known only to operators themselves. They depend, like those of the third class, upon a fluctuating movement of an escape-wheel, governed by an escapement, which may possibly, and often does, pass one too many, or one too few. As the type is a fixture on the wheel motion, when such a mistake occurs, the receiver must know from the sense or nonsense of what he receives by the telegraph that something is wrong with the machinery ; by no means an uncommon occurrence. Perhaps the best, or, notwithstanding its extreme complexity, the most efficient telegraph of this class, is the American one of Mr. House. Even when used under his own eye, it appears to be liable to serious mishaps, and would seem to be inferior in rapidity to either Morse's or Bain's telegraphs, which are of the second class.

In the telegraphs of the fourth class, the current transmitted along the wire has to bring into operation certain complicated apparatus or machinery, upon the correct movement of which depends the accurate transmission of the message. The superiority of the Universal Compa-

ny's Telegraph over the last mentioned class consists in simplicity, comparatively less cost, more rapidity, and no necessity for correcting errors, as even a mistake in one letter is not entailed on the one that follows it.

---

*Ocean Steamers.**

The discussion upon the Paper on "Ocean Steamers," by Mr. Andrew Henderson, Assoc. Inst. C. E., was commenced by quoting from an article in the *Edinburgh Journal*, by Professor Tennant, of St. Andrews, the dimensions of some of the large ships built by the ancients; whence it appeared that a ship, constructed by Ptolomœus Philopater, was 420 feet long, 56 feet broad, and 72 feet high from the keel to the prow; and was manned by four thousand rowers, four hundred servants, and two thousand eight hundred and twenty marines. Hiero, King of Syracuse, caused to be built, by Archias, the Corinthian shipwright, under the supervision of Archimedes, a vessel which appeared to have been armed for war, and sumptuously fitted for a pleasure yacht, and yet was ultimately used to carry corn; the dimensions were not recorded, but as there were twenty banks of oars, and three masts,—the timber for the mainmast, after being in vain sought for in Italy, being brought from England,—and the cargo was sixty thousand measures of corn, besides vast quantities of provisions, &c., for the crew, the dimensions must have exceeded those of any ships of the present day; indeed, Hiero, finding that none of the surrounding harbors sufficed to receive his leviathan, loaded it with corn, and presented the vessel, with its cargo, to Ptolemy, King of Egypt; and on arriving at Alexandria, it was hauled ashore, and nothing more was recorded respecting it.

Taking these dimensions as the basis for calculating the tonnage, by the old law, or builders' measurement, and, in accordance with the report of the late Tonnage Committee, taking the average tonnage of ships as amounting to twenty-seven hundredths of the external bulk, measured to the medium height of the upper deck, the burthen and cubic content of these vessels will be—

		Tonnage.		External bulk.	
Ptolomœus Philopater's ship	=	6,445	tons,	830,700	cubic feet.
Noah's Ark, . .	=	11,905	"	1,580,000	"

and contrasting with these a few modern ships:

Great Western, . .	=	1,242	"	161,100	"
Great Britain, ...	=	3,445	"	446,570	"
Arctic (American packet),	=	2,745	"	356,333	"
Hymalaya, ...	=	3,528	"	457,232	"

and, calculating by the same rules, taking the dimensions given in the prospectus of the Eastern Steam Navigation Company, their

Proposed iron ship, . = 22,942 tons, 2,973.593 cubic feet.

It was, however, stated that this vessel was intended to be 10,000 tons register, which might be correct, if it was built on the cellular system, and was measured internally, by the present law. This latter example

*From the London Mechanics' Magazine, November, 1853.

was only given to demonstrate the advantage of adopting the proposed system of using the mean of external and internal measurement as the basis of the calculation of the tonnage, and of recording all the dimensions, and the scale of burthen on the certificate of survey.

It was admitted that there was much ingenuity in the proposed system of descriptive measurement, but it was argued that the present law rather favored the construction of well-formed vessels, as the fiscal tax fell lighter upon them than upon bad ships. The utility, in a scientific point of view, as well as commercially, was strongly urged, of adopting a system of measurement which should record the dimensions, capacity, and scantling, and form a classification of the comparative merits of all ships.

It was suggested that the discussion would be more useful if it was, for the present, confined to the consideration of the advantages and disadvantages of the proposed large classes of sailing ships and steamers, with respect to their scientific construction, their capabilities for navigation, and their commercial economy, as the law of measurement could scarcely be combined with these questions.

The first point then considered was, the effect of heavy seas upon vessels of 400 to 600 feet long. The waves of the Atlantic were stated, by some captains of American "liners," to attain an elevation of about 20 feet, with a length of 160 feet, and a velocity of 25 to 30 miles per hour. Dr. Scoresby, in his paper on Atlantic Waves, gave about the same mean elevation for the waves in rather a hard gale ahead; on one occasion, with a hard gale and heavy squalls, some few waves attained a height of 43 feet, with a length of nearly 600 feet, and a velocity exceeding 30 miles an hour. Other authorities assumed even more than those heights and distances.

The amount of strength, to resist the impact of such waves, must vary with the length and size of a ship, and the materials of which it was constructed; and as the experience of the Britannia bridge showed, that a weight of 460 tons, at a velocity of 30 miles per hour, could be borne by a cellular tube of 460 feet span, it was demonstrated, that by the use of iron, almost any amount of strength could be given to a vessel, and as stability could be imparted by proper proportions, efficient vessels could be built of any dimensions, as had been exemplified by the *Great Britain*, which, after remaining ashore on rocks for several months, had been got off without serious injury. There were, however, objections to the use of iron alone for vessels; therefore many other systems had been essayed, such as all English oak, pine of large scantling, three thicknesses of diagonal planking, and iron framing with stout planking; this last combination, with the addition of fore and aft ties and water-tight bulk heads, was advocated for efficiency and economy.

The proportion of about six breadths for the length, were insisted upon; and it was noticed, that these were given as the dimensions of Noah's Ark, as recorded in Holy Writ.

The effect of heavy waves upon vessels of great length was discussed, particularly when in the trough of the sea, and without sufficient "way on" to enable the rudder to act; under such circumstances it was suggested that there might be a bow rudder, and a propeller so placed as to

assist the action of the helm in bringing the vessel round. The necessity for the formation of capacious docks and harbors expressly for such large vessels was pointed out, as until that was done they must load and discharge in the river or roadstead.

It was admitted, that the proposed record of construction would be of scientific value, but the advantage of making it a part of the ordinary register was questioned. The full consideration of the best form of fishing and life-boats which had been incidentally mentioned was strongly urged, on scientific grounds and in the interests of humanity. The questions of what were, scientifically, the limits of bulk of vessels, and power of engines, and commercially the most profitable dimensions for carrying cargoes and passengers, bearing in mind the period of inactivity, whilst loading in port, were shown to be the main points for useful consideration, as it was as much the province of the engineer to consider the commercial result, as the details of execution of any proposed construction, or plan of operations.

The innovations proposed by Mr. Roberts, and illustrated by his models, were examined. An examination was made of the project for transmitting letters between Holyhead and Dublin, at a speed of 22½ statute miles per hour; of that for communicating between New York and Liverpool in six days, at an average speed of 22 nautical miles per hour; and for steaming to Calcutta and back, without re-coaling, traversing a distance of about 25,000 nautical miles, at an average speed of 15 nautical miles per hour; using elaborate calculations and tabulated results, based on the duty performed by H. M. S. *Rattler*, with a given power, and under known conditions. Objections were raised to accepting 7½ knots per hour as the data for the present average rate of speed of ocean steamers: it was urged, that such an average must have been derived from the voyages of steamers of old date, and without regard to the later results deduced from the performances of the Cunard and Collins lines of steamships. The propriety of taking the *Rattler* as a model steamer was questioned, especially as the data were not given for selecting that vessel, it being argued that the *Rattler* had not performed a series of long voyages, under every variable line of immersion, or under such changes of weather and states of the sea, as to furnish data for such important deductions.

The advantage of increasing the proportion of length to breadth was apparent, if it was admitted that the cargo-bearing capacity of a vessel was thus augmented without materially affecting her direct resistance through the water, supposing her midship section to remain unaltered. The proper proportion of length to breadth for an efficient ocean steamer was, however, an intricate question. Taking the *Wave Queen* as an example, the length of that vessel had been stated to be thirteen times her beam; now such proportions might answer well for the river Thames, and a great speed might be attained; but such a vessel would, under certain circumstances, be unfit to navigate the British Channel. The same might be said of the American river steamers, which were reported to have attained almost fabulous rates of velocity; but such proportions as theirs, if attempted in ocean steamers, would only induce failure and loss of the vessels in heavy gales in the open ocean.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, December 15, 1853.

John Agnew, Esq., President, P. T., in the chair.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

A letter was read from the Royal Society, London.

Donations to the Library were received from Hon. J. R. Chandler, U. S. Congress; Lieut. J. A. Dahlgren, U. S. Navy; W. H. Shock, Esq., Chief Engineer, U. S. Navy; Richard Rush, Esq., Washington, D. C.: Dr. Cohen, and The Baltimore and Ohio Railroad Company, Baltimore, Md., and Ellwood Morris, Esq., Civil Engineer, Hillsborough, Ohio.

Donations to the Cabinets, from Washington Jones, Esq., Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement for November.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Exhibitions presented their report on the late Exhibitions of American manufactures.

Resignations of membership in the Institute (3) were read and accepted.

New candidates for membership in the Institute (10), and those proposed for membership at last meeting (134), were duly elected.

Nominations were made for Officers, Managers, and Auditors of the Institute for the ensuing year.

On motion, it was

Resolved, That the polls for receiving the votes of the Members of the Institute, for Officers, Managers, and Auditors, for the ensuing year, at the annual election, to be held on Thursday, January 19th, 1854, shall be opened at 3 o'clock, and closed at 8 o'clock, P. M.; and that seven members be appointed by the President, P. T., to receive the votes, and report the result thereof.

Mr. Fairman Rogers exhibited a model of a contrivance for preventing the annoyance of dust on railroads; invented by a gentleman of Delaware.

It consists of a platform, or guard, of any light material, which is fastened under the car, parallel to its floor, a few inches above the level of the rails, suitably shaped openings being made in it to allow the wheels to work through, and flaps attached to close completely the joints between the cars. A curtain of leather or canvas reaches from the end of this platform to the ground.

It is proposed to apply it to the engine and tender, as well as to the cars; the pilot or cow-catcher of the engine being sufficiently low to clear away any obstruction on the track which might injure the platform.

The inventor claims for this arrangement, in preference to that now in

use upon the Camden and Amboy and other roads, which is merely a curtain hung from the side of the car, that it will prevent the dust getting into the trucks and grinding them out; also, increased safety to any one falling through between the cars, the platform preventing a descent upon the rails.

Mr. Rogers also described a new chilled cast iron wheel tire, used by the Baltimore and Ohio Railroad, for the driving wheels of their locomotives. In the traffic of that road, with heavy grades and large loads, the necessary use of sand on the rails has been found to wear the ordinary Low Moor wrought tire into flat places upon the circumference of the wheel. In addition, the wrought tires being shrunk on hot, are exceedingly difficult to remove and replace when worn. The new tires are cast in contact with a cold iron ring, in order to chill the tread and flanch; and the outside of the wheel and the inside of the tire being carefully turned to fit each other, and slightly coned towards the outside of the wheel, the tire is dropped into its place, set by a few blows with a sledge, and brought to its bearing by bolts passing through lugs cast on the tire. By having tires ready turned to fit the engines, a set of wheels can be newly tired in a very short time. The cast also costs much less than the wrought tire, and resists the wearing action of the sand on the rails a much longer time.

Mr. Rogers also laid before the meeting, drawings of the locomotive engine constructed by J. A. Maffei, of Hirschaw, to surmount the heavy grades and stiff curves of the approaches to the Sœmmering Tunnel, Vienna and Trieste Railroad, Austria.

G. W. Smith, Esq., exhibited a drawing of the *Great Republic*, the largest clipper ship ever built, the tonnage being over 4500 register; the length, 325; beam, 53 feet; depth of hold, 39 feet; the aggregate length of mainmast, topmast, top gallant mast, and royal mast, being 276 feet; was built in Boston, during the present year; a movable steam engine on her decks is provided, partly to assist in working the ship, and capable of being transferred to a tug, for the purpose of towing her in calms. (We regret to learn, whilst this page is passing through the press, that this, the largest ship of modern times, has this day been consumed by fire.)

G. W. S. referred to the great destruction of bottles during the first process of fermentation of Champagne and other effervescing wines and liquors, and suggested that this might be remedied by enclosing them in great numbers packed together in closed metallic vessels, into which several atmospheres might be injected, and thereby produce any requisite pressure on the exterior of the bottles, and thereby offer an effectual resistance to the counter pressure within them. An arrangement of machinery could be easily adapted to remove the corks when necessary, for decanting the liquid, and at the same time maintaining the pressure unabated within the larger vessel. He believed that this plan which he had devised was worthy of a trial.

G. W. S. spoke of the various tests to which stone had been submitted for the purpose of ascertaining its relative liability to destruction or disintegration from the action of heat and cold, by freezing and thawing. The usual mode of late years has been to suspend a specimen of the stone to be experimented on, over a saucer containing a saline so-

lution, sulphate of soda being commonly employed, the stone being immersed in this solution, and then suspended over it until crystallization takes place. This process is again and again frequently repeated. The number and weight of the small fragments detached and collected in the saucer below, are supposed to indicate the relative durability of the stone if exposed to the action of freezing and thawing. Mr. S. maintained that this method was by no means strictly analogous, and that it would be far better to immerse the stone in pure water, and after removing it, to enclose it in a small metallic box in a freezing mixture, then thawing it, and repeating the experiment as many times as may be desirable.

Mr. S. also made some remarks on the stains which disfigure the surfaces of sandstone and marble in our buildings, &c.—their causes and means of preventing them when practicable. Some of these stains he referred to the development of vegetation from spores inclosed in the interstices of the sandstone for countless ages.

Dr. Rand exhibited C. D. Yale's heater for houses. It consists of an ordinary cylinder stove, surrounded at a suitable distance by a drum. The space between the stove and the drum is loosely packed with thin scrap iron coils. The object of the coils is to intercept the heat radiated from the stove, and communicate it to the air by conduction; also by contact with the stove to draw away its heat, thus giving a large extent of moderately heated surface. It is also believed that advantage will result in the more equable mixture of warm and cold currents by these coils, and that the rapidity of ascent of the column of warmed air will be moderated thereby. There are some ingenious arrangements connected with the model for regulating the supply of warmer air to various rooms.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on James J. Clark's Self-Winding Telegraph Register.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, a "Self-Winding Telegraph Register," invented by Mr. James J. Clark, of Philadelphia, Pennsylvania—Report:

That the nature of Mr. Clark's invention is fully set forth in the annexed description by the Inventor:

The Committee is satisfied from an examination of this instrument, that it will and does perform all that is claimed for it by the inventor, to wit:—maintain the spring within the drum at any tension at which it may have been adjusted, thus producing a constant and perfectly uniform motion of the drum, and consequently of the paper coiled upon it.

The apparatus is adjustable in all its parts, and the tension of the spring may be altered in a few seconds by the operator, without stopping the motion of the instrument, should such alteration be desired.

The importance of an entire uniformity of motion in the paper designed to receive and record telegraphic signals, particularly when the alphabet consists of a series of dots and lines, the latter depending for their length and consequent value upon the length of time during which the point of the style is kept in contact with the moving paper, is too obvious to require further notice.

The saving of time in the use of this instrument is considerable. In the ordinary telegraphic register, the operator is compelled to stop the communication every few minutes, in order to wind up the weight which acts as a moving power to the apparatus.

In that of Mr. Clark the instrument winds itself; the very revolution of the drum winding up, by means of the interposed battery, &c., the spring which causes the revolution.

In regard to the trouble and expense involved in the employment of the additional battery of three cups, demanded by the apparatus, the Committee is satisfied they are so trifling as not materially to detract from its usefulness, and are more than counterbalanced by the advantages before named.

In conclusion, the Committee regards Mr. Clark's invention as new, and, from the considerations above named, a valuable addition to the ordinary register for telegraphs. For the instrument deposited in the last annual Exhibition, and referred by the Committee on Exhibitions to this Committee for examination, it is recommended that the Committee on Exhibitions award a first premium to Mr. Clark.

By order of the Committee,

WM. HAMILTON, *Actuary.*

Philadelphia, April 14th, 1853.

Description by the Inventor.

My self-winding apparatus consists in attaching to an ordinary Morse telegraph register, a second electro-magnet, an armature attached to one extremity of a lever, and a click at the other; this click works into a ratchet wheel. To the lower extremity of the lever, and around the adjusting screw, a reacting spiral spring is placed. On the shaft of the ratchet wheel another ratchet wheel of larger diameter is placed, with two fixed clicks catching into the teeth of the wheel.

On the same shaft with these ratchet wheels is a small cog wheel working into another larger cog wheel, to the shaft of which last wheel the spring is attached. The other end of the spring is fixed to the box, as in a watch. The large wheel is fastened to the spring box, and revolves with it. This cog wheel gears into a small cog wheel placed on the first shaft, which communicates motion to the train of register wheels. On the same shaft with the small cog wheel is also placed a break circuit wheel, consisting of a metallic wheel with broad-faced teeth, against which a metallic spring rests, so that as this break circuit wheel revolves, the spring will fall into the cavities between the teeth, and alternately press against them.

The break circuit wheel, the coils of the magnet, and the wires from the battery are attached together as follows: a wire leaves the battery and proceeds to the coils of the magnet, thence to the spring, thence through the teeth of the break circuit wheel, thence through the metallic frame of the instrument back to the other extremity of the battery.

The operation of the several parts is as follows: When the spring unwinds and propels the train of register wheels it also rotates the break circuit wheel, and as it revolves, the spring alternately strikes the face of the teeth, and then falls into the cavities between them. Each time the

spring presses on the teeth, it, by so doing, closes a galvanic circuit extending from the battery around the winding magnet. When the spring falls between the teeth, this circuit is broken. The winding magnet is thus caused alternately to attract and release the armature; and the lever attached thereto moves the first ratchet wheel through the space of one tooth, and the ratchet on the same shaft half a tooth, so that one of the stationary clicks drops into one of the teeth; the ratchet wheel having double the number of teeth of the ratchet.

The number of teeth on the break circuit wheel is so proportioned, that the lever is caused to vibrate with sufficient rapidity to revolve the first ratchet wheel with the same velocity, proportioned to its gearing, with the spring shaft, that the spring unwinds in revolving the train of register wheels.

By the arrangement thus described, it will be seen that the unwinding of the spring is itself made to start and regulate the action of the winding magnet. When the clock work of the register is stopped, the break circuit wheel ceases to revolve, and the winding magnet ceases to vibrate the armature and lever.

BIBLIOGRAPHICAL NOTICES.

The Electro-Magnetic Telegraph, &c., &c. By LAURENCE TURNBULL, M. D. Philadelphia: A. Hart, 1853. 8vo., pp. 264, cuts and plates.

The greater part of this book was originally the matter of a course of lectures delivered before the class of the Franklin Institute, which were afterwards printed in the Journal, and then published in the present enlarged form. The value of a book of this kind consists necessarily in the care and industry used in collating the various descriptions, and the scientific judgment exhibited in the opinions expressed as to their relative merits. There is, we believe, no work in the English language which has any just claim to be compared with the present one, either in its scope or in the care and impartiality shown in its preparation. Two or more works in the German are entitled to great credit for excellence, but they are all defective from want of knowledge of the very great number of important practical inventions, both in this country and in England. The large work of the Abbè Moigno, published by a remarkably able and industrious man, is scarcely entitled to any other name than that of a general panegyric on Mr. Wheatstone and his inventions. His injustice to the American inventors, and especially to Mr. Morse, whose telegraph has after all been found by use heretofore, to be the practical one, is strongly marked, and renders his work nearly useless here. In the work of Dr. Turnbull, he has preferred describing the various inventions as much as possible in the words of the inventors, and to abstain from the expression of opinion on their relative merits. The statistics of the telegraph in this country will be found very interesting and valuable, and the author has now added an appendix, containing sundry decisions of our courts, which will be important to telegraphic operators and inventors.

As a whole, notwithstanding defects of style, and a certain dryness, which is unavoidable in a collection of mere descriptions without scienti-

fic appreciation, we regard this book as by far the best upon its subject which has yet been published. It is very well got up, and is fully illustrated by a great number of well designed and well printed plates and cuts.

The Book of Nature, an Elementary Introduction to the Sciences, &c. By FREDERICK SHOEDLER, Ph. S. Translated from the Sixth German Edition by Henry Medlock. Philadelphia: Blanchard and Lea, 1853. 8vo. pp. 692—cuts.

This is a suitable manual for reference for one who wants to get a very general and cursory idea of the various physical and natural sciences treated of, or to refer to specific facts or definitions belonging to them. As it is well written by an entirely competent man, it will, we hope, induce many to seek a deeper knowledge of these interesting subjects, from treatises devoted to each of them separately.

Practical Mineralogy, Assaying and Mining. By FREDERICK OVERMAN. Philadelphia: Lindsay and Blakiston. 1853.—12mo. pp. 230.

This is a valuable little work, containing much useful information for practical men, which ought to have occupied a little more time from the author, which might have borne fruit in the way of greater accuracy in the information. Take as an instance the statement on page 79, as to anthracite, that "it is, with the *exception of charcoal*, the *purest* mineral carbon of which we have any knowledge." Is charcoal a mineral? Is anthracite purer carbon than diamond or graphite? "Anthracite coal forms heavy veins and masses in the *metamorphic* rocks of the Eastern slope of the Alleghenies, but is *seldom* found on the *Western* side of that chain." Anthracite occurs in *seams*, never in *veins*—a practical miner should know the difference. Which one of the anthracite regions is on the *eastern slope of the Alleghenies*? Where are the metamorphic rocks in the coal basins? or on the Eastern slope of the Alleghenies? Where has anthracite been found on the *Western* side of the Alleghenies? Cases of carelessness of this kind are many, and much diminish the usefulness of the book. Such a work is, however, so much wanted, that we hope another edition will be published, and that in it these faults will be carefully eliminated.

The Microscopist, &c., &c. By JOSEPH H. WYTHES, M. D. Philadelphia: Lindsay & Blakiston, 1853. 12mo. pp. 212—plates and cuts.

This is a manual professing to give information on the important instrument of which it treats, and practical information as to its use. The value of the microscope in almost every branch of science and art is every day more widely acknowledged, and as a mere means of amusement few instruments compare with it. This work looks like a very good one.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

FEBRUARY, 1854.

CIVIL ENGINEERING.

On the Steam Jet, as a Ventilating Power. By Nicholas Wood, F. G. S., President of the North of England Institute of Mining Engineers.*

The steam jet was first proposed as a ventilating power by Mr. Goldsworthy Gurney, in 1835, to a "Committee of the House of Commons on Accidents in Coal Mines." His proposition to the Committee was "a common boiler, furnished with a small tube, leading to the shaft, and pointing either up or down, as you desire the current to be driven, placed in a cylinder, the size of which must be governed by the quantity of steam used, or the quantity of current you intend to make. A very small jet of steam, at 60 lbs. to the inch, of about the size of a goose quill, will dislodge 350,000 cubic feet of air in an hour."

Again, in 1839, Mr. Gurney proposed to the South Shields Committee steam jets as a ventilating power, and sent drawings of the mode of applying the jets, which may be seen in their Transactions. Mr. Gurney then proposed that the boiler should be placed at the top of the pit, and the jets placed within it, about 20 or 30 feet down. And he says, "16 jets of $\frac{5}{16}$ths area, fed by steam of 40 lbs. per square inch, placed not less than 30 feet in the upcast, and equally divided through its sectional area, would produce a current of air, at the rate of 20 miles per hour, in a shaft 41 feet area, or 72,160 cubic feet per minute."

In 1849, Mr. Gurney again brought forward, before a Committee of the House of Lords, the steam jet; and lastly, in 1852, before a Committee of the House of Commons. With regard to the mode of applying the jet, Mr. Gurney, in answer to Question 433, Lords' Committee, 1849, "Is it desirable to place them near the surface, or near the bottom?" said, "Save the rarefaction, and the little power given out by the heat of

* From the London Civil Engineer and Architect's Journal, December, 1853.

the steam, in the shape of heat, and lightening the column, it does not matter where it is placed; it is not worth consideration." And in answer to Question 434, says, "It is not worth calculation." And he mentions an experiment at Seaton Delaval, making the quantity of air due to the rarefaction of the steam only 6000 cubic feet per minute, the quantity of the steam jet being 33,000. He therefore assumes the ratio to be as 6 is to 33.

Notwithstanding the very flattering estimate of the powers of the steam jet, it does not appear that it was used at any of the collieries in this district until Mr. Forster adopted it, at the Seaton Delaval Colliery, in 1849, and, since then, it has been tried in some other collieries. It has always appeared to me, that great part of the difference of opinion which has arisen as to the utility and efficiency of the steam jet has been occasioned from a clear distinction not having been made between the effect arising from the rarefaction of the air in the upcast shaft, by the heat of the engine fires, and by the heat given out by the steam (when the boilers are placed at the bottom of the pit), and the mechanical effect, or propulsive power, of the steam jet, as a moving force, in producing ventilation. It is true, Mr. Gurney attributes little or no effect to the aids, which, as previously noticed, he says are "not worth consideration," but attributes almost the entire power of the steam jet, as a propulsive force.

We shall not, however, be able thoroughly to estimate the power and efficiency of the steam jet, unless we separate and determine by experiment, or in some other conclusive manner, what is due to each of the mechanical forces which contribute to form the entire power of the jet as a means of ventilation, in the different modes in which it has been or may be applied. In order to accomplish these, we shall have to consider separately, and subject to experiment:—

1st. The effect of the engine fires as regards rarefaction in the upcast shaft, when the boilers and jets are placed at the bottom of the pit.

2d. The effect of the rarefaction, and of the column of steam in the upcast shaft, when the jets are placed at the bottom of the pit, whether the steam is obtained from boilers at the bottom of the pit, or is conveyed by pipes from boilers placed on the surface.

3d. The mechanical effect of the jets alone, as a propulsive force, to produce ventilation.

In the consideration of the first of these, little explanation is required. If a fire is employed to pass underneath and around the boiler, to convert water into steam, (apart from the consideration of the effect of that portion of the heat communicated to the steam, and again given out in its passage up the shaft, which comes under the second head of the inquiries,) the surplus heat, passing into the shaft, acts upon the air in the upcast shaft in precisely the same manner, so far as regards the quantity of heat so communicated, as if such heat proceeded from a furnace, viz.: by rarefying the air in the shaft, and producing an amount of ventilation corresponding with the quantity of heat so passing off.

It is, however, worthy of remark, and it is a circumstance of some importance in this inquiry, that a considerable diminution of effect is sustained if such fires are of the ordinary description; the combustion of the coal in the engine fires is not near so perfect as when the coal is con-

sumed by a furnace. In the former case, the air is made to pass entirely through the grate bars, and through the fire, driving off a good deal of the volatile and combustible matter of the fire unconsumed; whereas, in the furnace, the air passes over the fire with great velocity, and the combustible matter is thus again thrown upon the fire, and is almost entirely consumed; indeed, in a well worked furnace, the combustion is almost perfect. This is well known to the profession: in upcast shafts, with engine fires at the bottom, volumes of smoke are almost continually issuing; whereas, in furnace ventilation alone, there is little or no smoke emitted. This is not a simple question of comparative consumption of coal to produce the same effect, as the smoke from the engine fires adds to the weight of the column of air in the shaft, and so tends also to diminish the effect of the rarefaction.

In the consideration of the second set of inquiries, that of the effect of the steam passing up the shaft, also requires consideration. It operates, first of all, in increasing the temperature, and by the rarefaction of such heat, adds to the ventilating power. We have likewise to take into consideration the weight of the column of steam, compared with the weight of a column of air of the same temperature. And we have to take into consideration that property of steam and air, in contact with each other, to combine mechanically, and present a united bulk different from that of the simple addition of the two volumes. I have however previously stated, that it was my intention in this paper to deal with this investigation in a purely practical manner. I shall therefore simply confine myself to a statement of the theoretical result of the above questions, as deduced by the most modern inquiries, without going more into detail than is absolutely necessary to illustrate the subject.

The effect of the heat of the steam upon the column of air in the shaft will be the same as that of a similar quantity of heat communicated in any other way, except only as modified by the weight of the column of steam, in the first instance, and still further modified by the properties of air and steam when mixed. According to the specific gravity of steam, as given by Dr. Thompson, it appears that a cubic foot of steam at 60° weighs 329·4 grains, when the barometrical pressure is 30 inches, and if f be any other pressure, we have as $30 : f :: \frac{329 \cdot 4 f}{30} = 10 \cdot 98 f =$ the weight of a cubic foot of steam, at the force f, and temperature 60°. Let t be the temperature at the force f, and let $t' = 60°$. Then, as previously shown, $\frac{459 + t}{459 + t'} =$ the bulk at the temperature t, supposing the bulk at 60° to be one cubic foot. Now, the densities being inversely as the spaces which the vapor occupies, we have $\frac{459+t}{459+t'} : 1 :: 10 \cdot 98 f :$ $\frac{5698 \cdot 6 f}{459 + t} =$ the weight of a cubic foot of vapor in grains, at the temperature t, and force f.

It has been ascertained that gaseous fluids, which do not chemically combine, mix together without condensation when the pressure is unaltered; and that, when they are saturated, a cubic foot of air absorbs

exactly a cubic foot of steam, as it would exist in a vacuum at the same temperature. (*See* Gen. Roy's Experiments, *Quarterly Journal of Science*, vol. xiii. p. 82; or *Daniell's Meteorological Essays*, p. 174.

If the bulk of air be a, at the temperature t, and f the force of the vapor at the same temperature, and p the pressure of the atmosphere, then, since the bulk a of the air mixes with an equal bulk a of the steam at the pressure f, the bulk of the steam at the pressure p will be

$p : f : : \frac{f\,a}{p}$; and the bulk of the whole, after mixture will be

$a + \frac{f\,a}{p} = \frac{a\,(h+f)}{p}$. (*See Tredgold on Warming and Ventilating Buildings*, p. 291).

These will be useful when we shall have to estimate what practical results can be obtained in other cases from the data resulting from the present experiments.

The next consideration is the mechanical effect of the jet of steam as a propulsive force. I have already noticed the mode in which Mr. Gurney proposed to apply the jet, either at the bottom or the top of the upcast shaft; the steam from a boiler, or more than one boiler, being made to pass through small apertures, and so produce a jet of steam issuing out of each of such apertures at a very rapid velocity, and acting on the air "by impulse, or *vis a tergo*," as Mr. Gurney expresses it, "driving the whole column of air up the shaft before it."

Mr. Longridge, in a paper read before the Institute of Mining Engineers, explains the action of the jet as "that of the friction of the steam rushing through the air with great velocity, and carrying it along with it." Whether it be the one or the other, or a combination of both, or a partial vacuum created by the rapid expansion of the steam, into which the air rushes, and in which manner it is carried along with it, and also, probably, that property of steam to mix with the air, I shall not here or at this time enter further upon, but shall proceed to the investigation of the mechanical power given out or produced by such jets.

It will be necessary, as in the case of the furnace, to ascertain the amount of mechanical force exerted by jets of steam of given dimensions, and number in lbs. pressure per square foot of area of shaft, or horses' power, which we shall first of all do by ascertaining the evaporating power of a boiler, or a certain number of boilers, such as are used in the collieries where the steam jet has been applied. The form of boiler ordinarily employed is cylindrical, with hemispherical ends, generally 30 feet long by 5 feet to 5 feet 6 inches diameter; high pressure, of course. The evaporating power of such a boiler we may take at about 50 cubic feet of water per hour; and as the evaporation of one cubic foot of water per hour is generally taken to represent a horse's power, or 33,000 lbs. lifted one foot in height in a minute, we may take one of such boilers, used as a mechanical force, or as made to act as a jet of steam, as representing 50 horses' power, and so on for any greater number. We shall now inquire what number of jets such a boiler will supply with steam, say 40 lbs. per square inch.

Mr. Vivian quotes, in his evidence in 1849, "a Cornish boiler, 30½

feet long, 6 feet 2 inches diameter, as supplying a steam jet with an opening of $\frac{3}{4}$-inch square, the safety valve lifting at 50 lbs. per square inch;" thus making one jet, of an area of ·5625 square inches, pass all the steam of such a boiler at 50 lbs. per square inch.

In an experiment which I made at Hetton Colliery with two boilers, each 26 feet long and 5 feet 4 inches diameter, the evaporation was 93 cubic feet of water per hour, into steam at 40 lbs. per square inch; and this quantity of steam was barely sufficient for the supply of 37 jets $\frac{1}{4}$-inch diameter, or 1·8133 inches area. But this evaporation was more than would supply the same number of jets $\frac{3}{16}$-inch diameter, or 1·0216 inch area.

At Killingworth, I found the evaporation of three boilers, each 34 feet long and 5 feet 1 inch diameter, equal to 170 cubic feet of water, into steam at 40 lbs. per square inch per hour; and this quantity of steam was also barely sufficient to fully keep up 29 jets $\frac{3}{8}$-inch diameter each, or 3·203 inches area, the boilers being, in this case, vigorously fired.

At Tyne Main Colliery, two experiments were made, the jets being placed at the top of the pit, a short distance from the boilers, and, consequently, little or no condensation. In one experiment there were 33 jets $\frac{3}{16}$-inch diameter each, and 28 jets $\frac{3}{8}$-inch diameter each, the total area being 4·0003 inches. There were two boilers, each 30 feet long, and 6 feet diameter, with hemispherical ends; the evaporation was 115 cubic feet of water per hour, and the pressure of steam 22·5 per square inch. The boilers were very hard fired, and the steam kept up with great difficulty. The other experiment was with the same boilers, steam at 40 lbs. per square inch; 61 jets $\frac{3}{16}$-inch diameter each; area of jets, 1·684 inch; and the evaporation was 109 cubic feet of water per hour, but the steam was blowing off strong all the time, the evaporation being more than the jets could pass.

The velocity with which elastic fluids rush into a vacuum is that which a heavy body will acquire by falling through a homogeneous column equal to the height due to the pressure or elasticity of the fluid; and the velocity with which a fluid of one degree of elasticity will rush into an atmosphere of a different degree of elasticity, is that which a heavy body will acquire by falling through a homogeneous column equal to the height due to the pressure, or difference of degrees of elasticities of the two fluids. If we have, therefore, the degrees of elasticity or density of steam, we shall know at what velocity such steam will rush into the atmosphere, through a jet or aperture, out of a pipe containing a continuous supply of steam at such a density. This theorem is well known, and is—

$$v = 8\sqrt{86 \cdot 5\,(459 + t')}$$

t' being the temperature of the steam above the pressure of the atmosphere. (*See Tredgold on the Steam Engine*, p. 89). This expression of velocity is, however, correct only when the motion is free from friction, or unretarded. Mr. Tredgold states, that the "velocity through a tube, from two to three diameters in length, should be 6·5 instead of 8." In the case of the steam jet, however, the jets are necessarily at some distance from the boilers, and the steam will be conveyed from thence by steam pipes of different diameters, and, consequently, we may assume that the

velocity will be further diminished. The velocity of steam at 40 lbs. pressure per square inch, or 288·4° temperature, will be—

$v = 6{\cdot}5 \sqrt{86{\cdot}5\,(459 + 288{\cdot}4)} = 1652{\cdot}7$ feet per second, the velocity with which the steam would issue from the jets.

The quantity of water evaporated at Hetton was 93 cubic feet per hour; we then have,

$$\frac{93 \times 506 \times 144}{3600 \times 1{\cdot}8133} = 1038 \text{ feet per second,}$$

the velocity with which 93 cubic feet of water converted into steam of 40 lbs. pressure per square inch, 506 bulk per minute, would pass through an aperture of 1·8133 inches in area. And at Killingsworth—

$\frac{170 \times 506 \times 144}{3600 \times 3{\cdot}203} = 1074$ feet. And at Tyne Main, No. 1 experiment,—

$\frac{115 \times 959 \times 144}{3600 \times 4{\cdot}003} = 1102$ feet; and No. 2 experiment,—

$\frac{109 \times 504 \times 144}{3600 \times 1{\cdot}684} = 1311$ feet per second, the velocity of the steam out of the jets. The theoretical expression of these experiments being about 4·25 on the average (the last experiment not passing all the steam), instead of 6·5, as given by Tredgold; which is probably the more correct expression, as Tredgold gives 5· as the expression when the steam issues through a thin plate, and 5·45 through a tube of two or three diameters in length, projecting inwards.

Assuming 4·25 as the expression, we would have the velocity with steam at 40 lbs. = 1080·6 feet per second; and at 50 lbs. = 1088·4 feet per second. Having thus the number of boilers, or area of surface of evaporation, and reckoning in round numbers, 3 sq. ft. of surface of evaporation for each cubic foot of water evaporated, we shall know the mechanical power employed in any steam jet apparatus, and resolving the quantity of water into steam of the elasticity intended to be used, and adopting the theorem

$$v = 4{\cdot}25 \sqrt{86{\cdot}5\,(459 + t')}$$

t' being the temperature of the steam equivalent to the elasticity intended to be used, we can also determine the number of jets to be used.

And if we wish to know the number of horses' power of the steam employed in the jets, or the pressure per square foot of area of shaft, we can also determine these. Thus, suppose the pressure of steam employed in the jets to be 40 lbs. per square inch = 288·4° Fah.

Then $4{\cdot}25 \sqrt{86{\cdot}5\,(459 + 288{\cdot}4)} = 1080$ feet per second, the velocity with which the steam will issue from the jets.

Take the case of Tyne Main. 61 jets $\frac{3}{16}$-inch in diameter each = 1·6843 inch area: we have, as above, 1·6843 inches of steam, at 40 lbs. pressure, with a velocity of 1080·6 feet per second. Then $\frac{1080{\cdot}6 \times 1{\cdot}6843 \times 60}{144} =$ 758·37 cubic feet of steam per minute, and as the bulk of steam as compared with water is as 506 : 1, we have $\frac{758{\cdot}37}{506} = 1{\cdot}5$ cubic feet of water

per minute, or 90 cubic feet per hour required to be evaporated to supply jets of the area of 1.6843 inch, with steam at 40 lbs. pressure per square inch.

And if we require to know the pressure per square foot of area of shaft, we have 758·37 cubic feet of steam, to act upon an area through the cylinders, of 40·25 feet, with steam at 40 lbs. per square inch pressure, now $\frac{758\cdot37}{40\cdot25} = 18\cdot84$ feet per minute, the quantity of steam supplied at 40 lbs. But the velocity of air is 1231·6 feet per minute, (viz: 49·574 cubic feet of air per minute passing up the shaft, the area of which is 40·25 feet,) therefore, as 18·84 feet : 1231·6 feet : : 40 lbs. : ·6118 lbs. pressure per square inch, or $\cdot6118 \times 144 = 88\cdot10$ lbs. per square foot of area of shaft.

$$\text{And } \frac{88\cdot11 \times 40\cdot25 \times 1231\cdot6}{33\cdot000} = 132 \text{ horses' power.}$$

---

*Apparatus for Stopping a Railway Train.**

A very ingenious contrivance, consisting of the introduction of a series of transverse rollers under the engine and carriages of railway trains, has been invented by Mr. E. Palmer, of Woodford-green, Essex. The circumference of the rollers is placed at a short distance above the rail, and while the train proceeds in the ordinary manner they remain stationary; but in the event of the wheels leaving the path, the rollers come into instant operation, sustain the load, and, having a flanch on the inner end, act as a second series of wheels, which, supposing them to be applied to an engine, keep the propelling wheels from the ground; and, therefore, however quickly they may be revolving, their power ceases on the rollers touching the rails. The same gentleman has also invented a powerful drag carriage, formed by two strong frames, reaching from the rails to a little above the wheels in height, with projecting ends at the base—each having four slanting beams to strengthen the frame, one on each side of each wheel. The lower part of the frames has cuttings, through which the wheels work on the rails, a forked cutting from end to end to tighten on the rail when required, and are attached parallel to each other by cross-beams, well screwed in place; each frame has four iron plates reaching from the base to the top part, (one on each side of the axletrees,) and allows the carriage to move up and down. There is also a strong sliding frame, with four inclined planes attached thereto, which works inside the wheels, and above the axletrees and bearings, and upon which are the usual springs and scroll iron, supporting the carriage, which are attached to four cross-beams. This invention has the combined advantage over the brakes now in use in being more powerful and applicable at the proper place or part of the train, and in being self-acting—the sliding frame having a raised part at one end, which comes in contact with the buffers of an engine coming up against it, and projecting a sufficient distance beyond the carriage, that the inclines may be pushed forward, and the carriage lowered just previously to the rollers or wheels

* From the London Mining Journal, No. 953.

of the engine coming on the lower projecting parts of the frames for that purpose, which circumstance immediately adds half its weight to the drag carriage, which stands firm, receiving the shock on powerful buffers, transferring it to the rails by means of the forked cutting above alluded to.

For the Journal of the Franklin Institute.

Description of a new Railroad Switch Pointer. Invented by Mr. John Maston, of the Saratoga Shops. By Fairman Rogers, Civ. Eng.

The importance of a Switch Pointer which will show the engine driver at a glance, and without chance of mistake, whether the switch at any junction is in its proper position, is so great, that many forms of it have been invented, none of which have yet given perfect satisfaction, being either too clumsy, too complicated, or liable to be mistaken in their positions.

The ordinary ball attached to the upper end of the long lever, indicates the position of the switch only by the inclination of the lever from or towards the line of rails; consequently, in dark and misty weather, the lever, which is generally thin and black, cannot be seen, and the position of the ball of itself indicates nothing.

The vertical Switch Pointer, which shifts the rails by a crank at the lower end, and changes the vane at the top *across* the line of rails, or *parallel* with them, while it possesses great compactness and simplicity, has the defect, that when the switch is set for the main track, the *edge* of the vane is towards the engine driver, presenting the same appearance as if the vane were broken off altogether—an accident, by the way, which not unfrequently happens. On this switch also it is difficult to arrange lights for night signals.

The switch to be described, invented by Mr. John Maston, of the Repair Shops in Saratoga, N. Y., is intended to obviate these difficulties, and to indicate always unmistakeably for which line of rail the switch is set.

The arrangement will be easily understood by reference to the cut.

The dimensions are given for a particular case, and can be varied to suit circumstances.

The long lever of the pointer moves about a pin through its lower end, and at a distance of 1′ 1″ from this pin is jointed the horizontal bar which shifts the rails, which in this case switch through 4″.75. The entire length of the long lever from the bottom pin to the centre on which the vane is hung, is 6′ 6″.

The lever moves between the jaws of an arc 2′ 6″ from the ground, in the upper edge of which notches are made, and a spring bolt on the lever retains it in its place when set for either track—a lock can very conveniently be applied to this bolt. The vane is of cast iron, about 1′ 10″ in length, and hung upon the upper end of the lever by a pin passing through it near its centre of gravity, the round end of the vane slightly preponderating. On a lug projecting downward from the arc, a rod is

jointed at a distance of 2′ 9″.75, vertically above the lower end of the lever; the other end of this rod, which is 4′ 8″ long, being attached to a pin in the centre line of the vane, near the *point*, 11″.5 from its point of suspension. This rod is forked where it crosses the lever, as represented in the drawing, embracing a pin in the lever, to make the reversing action more steady.

When the switch is set for the main track, the rod and lever, by their relative proportions, keep the vane in a vertical position, pointing directly upwards, as shown in fig. 2, showing the *whole flat side* of the vane to the engine driver, instead of the *edge*. Then, when the bars are shifted on to a siding, the lever moves over towards the siding, and the vane is turned by the action of the rod through a quarter of a revolution, pointing towards the track for which the switch is set, as in fig. 1.

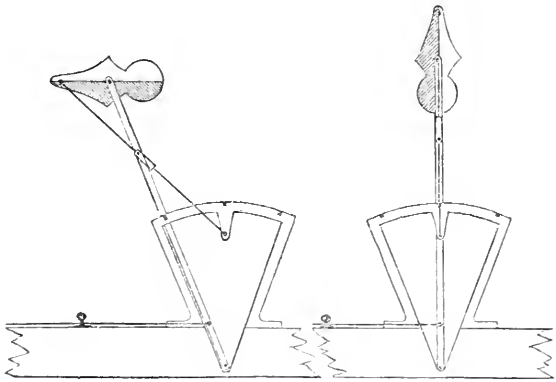


Fig. 1. Fig. 2.

Scale $\frac{1}{4}$ inch to the foot.

It is obvious, that if the switch is for three tracks, when turned to the other side, the vane will point in the right direction for the third track.

The vane is represented in the cut as painted half red, and half white, so as to be distinguished against any background.

The proportions given, can of course be modified to suit particular cases. If the sinking of the lower end of the lever below the ground should be thought objectionable, it can be raised, and the switch rod bent down to the rails, or it may be made a lever of the first order, in which case the arrangement of the shifting rod must be altered.

Its advantages appear to be principally, great distinctness, the position of the vane being so decided as not to be possibly mistaken, and being not an arbitrary signal, but one easily understood, the vane actually pointing towards the track for which the switch is set. At night, different colored lights being hung at the two extremities of the vane, their relative positions will indicate as well as the vane itself.

In case the vane and its connexions are out of order, so as not to indicate the change of track, the rod will prevent the lever from moving freely, and thus attract the attention of the switch tender.

It is not composed of any complicated pieces, requiring expensive patterns or very exact forging, and is very easily repaired. Most of the ordinary lever pointers could be altered to this plan.

This Switch Pointer has had the great advantage of the test of experience. It is not merely a model, but has been in constant use about the stations at Saratoga and Ballston, and on the main line, where I am assured by the engine drivers, who are necessarily good judges, that it gives more satisfaction than any switch hitherto used. An objection which may probably be urged against it, is, that the rods may be easily bent; but in practice this does not appear to be the case; at any rate, they being of wrought iron, can be set upon an anvil in a few minutes, if they become bent.

Having found this switch in the course of my rambles last summer, I am induced to offer this description, from the belief that it is quite an ingenious apparatus for its purposes, and not at all generally known.

---

*On Hollow Railway Axles.**

The following remarks from the Lond. Mech. Mag., are a continuation of those from the Lond. Civ. Eng. Journ, published in this Journal for December 1853, p. 361.

[Com. Pub.

Mr. M'Connell exhibited a number of specimens of the axles tried in the experiments, and specimens of the hollow axles cut in two longitudinally, showing the thickness of metal to be quite uniform throughout the axle and journals. He also showed and explained an instrument used for measuring accurately the thickness of the metal at the shoulder of each journal, and in the journal after the axle was turned; it consisted of a double sliding gauge, one sliding part being inserted into the open end of the axle and shaped to fit closely to the inside of the shoulder, and the other sliding part fiting the outside of the journal and axle; the whole gauge was held steady on the body of the axle by the arm and clip. When the gauge was adjusted by a compound sliding motion so as to fit the axle inside and out, the exact position of the outer sliding portion was marked by bringing a screw stop in contact with it, and it was then withdrawn sufficiently to allow the gauge to be disengaged from the axle by drawing the inner slide out of the axle; the outer slide was then brought back to its former position by sliding it home to the screw stop, and the space thus left between the edges of the inner and outer slides gave a correct outline of the thickness of the metal, which was traced at once on paper. Each axle was examined in this manner and registered before it was sent out to work, so as to provide against any axle being turned out in an imperfect state from the journal being accidentally cut into the metal too much at the shoulder.

The Chairman (Mr. Samuel H. Blackwell) remarked, that in the fracture of the hollow axle all the iron appeared fibrous, but the fracture of the solid axles was mostly crystalline.

Mr. M'Connell said he had found the same differences in all he had

* From the London Mechanics' Magazine, October, 1853.

tried: the iron of the hollow axle was as fibrous throughout as the best bar iron.

Mr. W. Mathews inquired what was the saving in weight of the hollow axles, and whether they had yet been applied extensively?

Mr. M'Connell replied, the reduction in weight was about $\frac{2}{5}$ths theoretically to obtain the same strength, but it had been taken at $\frac{1}{3}$d of the solid axles, to be on the Midland, and Great Northern Railways, safe side. The hollow axles were being extensively applied on the North Western, and more than 500 had already been made; some had been at work for nine months with entire satisfaction.

Mr. W. Mathews asked what was the relative cost of the hollow axles, and whether any difference was found in the crystallizing of the iron from the effects of working?

Mr. M'Connell said that no observations could be made on that point yet, and it would be difficult to arrive at any conclusion upon it, except from actual long work.

Mr. Norris observed that in the fractures of the new solid axles there was considerable variation, some parts being fibrous and other parts crystalline. He said he had tried many old axles that had been twenty years at work on the Liverpool and Manchester Railway, and none of them appeared crystalline on breaking off the journals, though several new ones were found to break crystalline; the new ones were about $\frac{1}{2}$-inch larger diameter in the journals. He doubted any crystalline effect being produced by working on the railways: he thought it depended more on the original manufacture.

Mr. Slate remarked, that iron would be crystallized if over-heated in the furnace, and the hollow axles might be injured in this way without proper care.

The Chairman said the most fibrous bar could be made crystalline in one part by overheating it.

Mr. Clift suggested, that less heat might be required to weld the hollow axle than the solid one, on account of the reduced substance of the iron, which would be less injurious to it.

Mr. M'Connell observed, that in the case of the sling chains for holding up in forging large bars, and other similar instances, the continued concussion was found to have the effect of making the iron break in a certain time quite crystalline, though it had been quite fibrous originally; this was known to take place so regulorly, that the time of breaking was reckoned upon, and they sometimes lasted only a few months. In the hollow axle there was a different condition of the iron from the solid axle, as in the latter the iron in the centre was not so solid as the outside, because the pressure was only applied on the outside, and the larger the bar the more this was perceived; but in the process of manufacture of the new hollow axle, in consequence of the internal pressure combined with the external, and the small thickness of the metal, the whole axle was made as solid as the outside of an ordinary axle. It had, in fact, two skins, one outside and one inside.

Mr. Slate remarked, that the skin of iron was generally looked upon as stronger than the rest, but he doubted whether the skin was really of much importance to the strength, as it could only be thin film of scale

oxide. He should like to see the experiment tried of a hollow axle bored out and turned so as to remove the skin, and expected it would be found to make little difference.

Mr. M'Connell said the skin was important in cast iron, and the strength was considerably diminished if the skin was removed; he thought something of the same kind applied to wrought iron.

Mr. May hoped the experiment suggested would be tried; he thought the ordinary idea of the skin was a delusion, both in cast and wrought iron, and he believed there would even be found more strength per square inch in the area left if the skin were planed or turned off.

Mr. Duclos observed, that in cast iron the skin would be different in composition, assimilating to steel, and harder than the rest of the metal, if not stronger, according as it was more or less chilled, but in wrought iron the skin was mainly oxide of iron, and was really weaker than the pure iron.

Mr. Slate thought a cast iron bar planed down $\frac{1}{8}$th inch on each side would prove quite as strong per square inch as before.

Mr. James Nasmyth said he had tried a careful experiment on that very point; he cast some bars $2\frac{1}{4}$ inches square, and planed some of them down on each side 2 inches square, and he found these were 10 per cent. weaker for the proportionate transverse breaking strength. These bars were green sand castings, and consequently partially chilled; loam castings would not probably show the same effect; he considered the effect of chilling was to increase the strength.

Mr. Slate said he had made a somewhat similar trial, though not so careful an experiment, and he had not perceived any difference in the strength of the skin.

Mr. May observed, that $\frac{1}{8}$th inch on every side might be too much to remove for ascertaining the relative strength of the skin alone, as the interior of a large bar was not so strong. It has been ascertained by the experiments of the Government Commissioners, that a cast iron bar, 3 inches square, was only $\frac{2}{3}$ds the proportionate strength of a bar 1 inch square, as the centre of the bar becomes less solid in cooling; consequently, a bar 1 inch square, cut out of the centre of a 3 inch bar, would be considerably weaker than a bar cast 1 inch square, and not from the circumstance of the skin being removed, but from the iron being less solid; if only about $\frac{1}{50}$-inch were planed off a bar, it would remove the skin, but he thought the strength would be found not to be injured.

Mr. J. Nasmyth considered the skin effect extended more than $\frac{1}{8}$th inch deep, at least the chilling was perceptible so far.

Mr. G. England remarked, that if the less dense part of a solid axle at the centre were taken out by boring, the axle would not be proportionately diminished in strength; and this was in effect done in the hollow axle, with the additional advantage of the internal pressure, making the iron as sound throughout as in a thin bar, and considerably sounder and stronger than it could be in a large bar or shaft.

The Chairman said it was certainly much easier to make a bar 1 inch thick, of good quality and fibrous throughout, than one 3 or $3\frac{1}{2}$ inches thick; and in effect the hollow axle was a bar less than an inch thick throughout, in place of the ordinary solid axle, $3\frac{1}{2}$ or 4 inches thick.

Mr. M'Connell thought it had to be defined what was meant by the term skin; in forging any bar it became denser gradually at the surface, and consequently stronger, the effect penetrating to a greater or less depth, according to the circumstances, and it was that he referred to, not a mere film on the surface.

Mr. Slate remarked, that in reference to the crystallization produced in iron by concussion, he thought the effect did not take place unless the strain was beyond the elastic limit more than five or six tons per inch, so as to cause a permanent change in the arrangement of the particles of the iron. He had tried an experiment in connexion with Mr. Wild, in which a weight was suspended by a bar an inch square, and was lifted up and down eighty times per minute by an eccentric worked by a steam engine constantly, night and day. This was continued for a length of time that was supposed equivalent to the effect of twenty-five years' work, but no change or crystallization in the iron was perceived.

AMERICAN PATENTS.

List of American Patents which issued from December 13th, 1853, to January 3d, 1854, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

DECEMBER 13.

15. For an *Improved Hydrant Valve;* James Cochrane, City of New York.

Claim.—"What I claim is, 1st, Combining with the issuing pipe and main cock, or two way cocks, flat, or conical valve and leakage wasteway, a piston and chamber, or a partly flexible chamber, emptying into and receiving from the issuing pipe water, between the interval of opening and closing the main and leakage wasteway. 2d, The shutting force by hydrostatic pressure and gravity of the ordinary waste water; also, the general arrangement of the moving parts by the gravity to favor the shutting forces, substantially as described."

16. For an *Improvement in Bit Stocks of Braces;* John Comstock, New London Connecticut.

Claim.—"What I claim is, the arrangement of the ring, with its pin or screw, in combination with the eccentric-shaped back catch, and the helical spring, the whole being combined and arranged substantially as set forth."

17. For a *Mode of Fixing the Colors of Cotton Umbrellas;* Norman Cook, City of New York.

"The nature of my invention consists in applying to the cotton or gingham covering, after the completion of the umbrella, a sizing of diluted gum, india-rubber paste, or cement, which filling the pores of the cloth, enables the covering to retain its color under the circumstances which at present cause the fading of the cotton and gingham."

Claim.—"I do not claim the composition of the preparation applied; neither do I claim the application of such preparation for rendering cloth water-proof. But what I do claim is, the application of a dilute solution of india-rubber paste or cement, substantially as described, to cotton or gingham umbrella coverings, for the purpose of enveloping the fibre of the cloth, and setting the color of the same, without adding to the weight of the umbrella, as set forth.

18. For an *Improvement in Car Wheels;* Carmi Hart, Bridgeport, Connecticut.

"My wheel consists of a hub and rim in the usual form, the depth of the hub in the line of the axle being considerable, to form a sufficient space for the base of the arch between the two plates; the hub and rim are connected by two plates, which meet together about two-thirds the distance from hub to rim, and thence unite as one plate to the rim;

the front and back plate resting upon the front and back of the hub, forming an arch with its base resting upon the hub. The back plate is curved in ogee from the hub to the rim, curving out gently from its point of contact with the inner end of the hub, and curving also gently outward as it connects with the rim and its inner edges."

Claim.—"What I claim is, the arrangement of the plates of the wheel in the arch at the hub, so that its opposite sides curve in similar curves, adapting themselves to each other, and are also ogees, and whose continuation from the apex or point of union is also an ogee to the rim, in combination with the spokes or radii, which are ogees on the surface of the inner plate, and also ogees sidewise, and forms a continuous part of the inside plate itself."

19. For a *Hinge for Inkstand Covers;* Joseph Nock, Philadelphia, Pennsylvania.

"The nature of my invention consists in providing the inkstand, or ink-well cover, with a curvilinear hinge on the top of the inkstand, or ink-well cover, which cover is to be closed to form a round or smooth turned face, and gives an opportunity of cleansing when soiled, inside as well as outside, and can be used by any scholar in the public schools, or any other place, where writing ink is to be used, as it is the most convenient in opening and shutting, and of course keeps the ink clean, and saves the ink from evaporating when shut."

Claim.—"What I claim is, the application of the stamped round part, and the solid part, (or the moving lid, or cover,) fitted together as a hinge, which forms a rounded, smooth turned face, and the manner in which the pin is connected with both parts, as described, using for that purpose the aforesaid 'two pieces to form a regular curvilinear or round turned hinge,' made of any materials which will produce the intended effect."

20. For an *Improvement in Spring Clamps for Clothes Lines;* F. S. Hotchkiss and C. W. Blakeslee, Northfield, Connecticut.

"The nature of our improvement consists in joining the two pieces of wood or other material, as two levers, by inserting a piece of plate brass, or other metal, by both ends, so inserted by one end in each lever as to form a kind of hinge, by which the one end of each lever is pressed together by the spring inclining to straighten itself, and when pressure is applied to the two opposite ends, then by such pressure the mouth of the pin is opened. The two levers are hollowed out near the lower ends so as to embrace the line. These are also very convenient nippers for holding papers and other material, as sewing work, and when made with longer cusps are very handy pliers for picking up small articles."

Claim.—"What we claim is, the connecting together of the two levers as above described, by one piece of metal, in such form and manner as to constitute both spring and hinge, for the purpose set forth."

21. For an *Improvement in Turnkeys;* Melvin Jinks, Wayland, New York.

Claim.—"What I claim is, the adjustable claw, constructed and arranged substantially as described, in combination with the claw and the rolling fulcrum, having a limited motion."

22. For an *Improvement in Bedstead Fastenings;* Westley E. Merrill and Freeman Tupper, Nashua, New Hampshire.

Claim.—"What we claim is, securing the posts and rails together, by means of the corner irons attached to the ends of the rails, and the clamp or dog attached to the posts, the said corner irons and clamps, or dogs, being constructed and arranged substantially as described."

23. For an *Improvement in Harvesters and Binders;* Joseph E. Nesen, Buffalo, New York; patented in England, August 27th, 1853.

"The nature of my invention consists, 1st, in the employment or use of an endless apron, having an intermitting motion for the purpose of conveying the grain in proper quantity to the binding hooks; 2d, in gathering in bundles by means of binding hooks, the grain cut by the reaper, said grain being carried up to the hooks by the endless apron; the binding hooks are operated by means of sliders, having a reciprocating motion; 3d, in the combination of the binding hooks and endless apron.

Claim.—"I do not claim the slotted fingers, nor the teeth; neither do I claim an endless belt irrespective of the peculiar motion communicated to it; but what I claim is, 1st, giving the endless apron an intermitting motion, for the purpose of carrying the grain to the binding hooks, at intervals, and in proper quantity, said motion being communi-

cated to the apron by means of belt-shipper, worked automatically from some moving portion of the machine, substantially as described; 2d, gathering the grain in bundles or sheafs, by means of the binding hooks, or their equivalents, said binding hooks being arranged and operating in the manner as shown, motion being communicated to them by means of the reciprocating bars, substantially as described; 3d, the binding hooks, in combination with the endless, intermittently moving apron, the hooks and apron being constructed, arranged, and operating in the manner and for the purpose substantially as set forth."

24. For an *Improvement in Sectional Bedsteads;* Charles Page, North Danvers, Massachusetts.

"The nature of my invention consists in certain improvements upon a sectional bedstead, by which it is made capable of being converted at any time into an invalid bedstead, in which the position and inclination of the body and head of the patient may be adjusted independently of each other, and his feet are furnished with an elastic, yielding rest, much conducing to his ease and comfort."

Claim.—"I do not claim a sectional bedstead, the portions of which revolve upon hinges, for the purpose of more convenient transportation, or of raising the head, as may be required; neither do I claim securing the mattress permanently to the bedstead; but what I do claim is, the combination of the adjustable section with the revolving head and foot boards, constructed and operating in the manner described; by which means the bedstead may at any time be converted into an invalid bedstead, and extended in such manner that the body and head of the patient may be raised and lowered, independent of each other, his feet being furnished with an elastic foot board, in the manner set forth."

25. For an *Improvement in Peg Rasps;* Joseph Sawyer and Lyman Clark, South Royalton, Massachusetts.

Claim.—"We do not claim hanging the rasp of a tool for cleaning out pegs from the inside of shoes and boots, upon a pivot, and allowing it to adjust itself to the position required, as this has been done before, and is furthermore liable to several objections, the removal of which is the object of our present invention; but what we do claim is, the combination of the spring bolt and thumb piece, or their equivalents, with the pivoted rasp, constructed and operating in the manner and for the purpose substantially as described."

26. For *Improvements in Machines for Cutting Sheet Metal;* John Wilmington, South Bend, Indiana.

Claim.—"I do not claim the rotary shears; but what I do claim is, the vice, in combination with the tram upon which it moves, and upon which the sheet rests, during the operation of cutting, as set forth."

27. For *Improved Pump Valves;* Joel R. Bassett, Assignor to James B. Williams, Cincinnati, Ohio.

Claim.—"What I claim is, 1st, the construction, as described, of the puppet check valve, serving also as the piston of a pneumatic spring, and provided at its lower end with a small starting valve, substantially in the manner and for the objects explained; 2d, the segmental cylindric slide valve of the discharge openings, having prongs, as described, connecting it with the chuck valves upon the supply of the openings, so that the motion of the supply valves shall be communicated to the discharge valve, as explained."

28. For an *Improvement in Machines for Moulding Brick;* John Butler, Assignor to James Lully and John Butler, Buffalo, New York.

Claim.—"What I claim is, two hinged followers, so constructed and operated as to press the clay uniformly into the moulds, that is, each end alike, whether operated by gears or levers."

DECEMBER 20.

29. For an *Improvement in Grain and Grass Harvesters;* John E. Brown and Stephen S. Bartlett, Woonsocket, Rhode Island.

Claim.—"What we claim is, 1st, The double bladed or two edged knife, or its equivalent, so constructed as to cut in each direction, as it is vibrated, substantially as described. 2d, The knife, in combination with the curves and teeth. 3d, The mode of operating the double bladed knives or cutters, by means of the rack and pinions, substantially as set

forth. 4th, The arrangement of the devices which communicate the motion from the internal part of the driving wheel to the rack, substantially as set forth. 5th, The gearing, arranged and combined so as to work within the main wheel, and operate the crank upon the axle of the main wheel, substantially as described."

30. For an *Improvement in Operating Brakes by Signal Card;* William G. Creamer, New Haven County, Connecticut.

Claim.—"I do not claim the use of springs or weights to operate the brakes of a car; nor do I claim the use of a cord, or its equivalent, to act upon such springs or weights, or directly upon the brakes; neither do I claim the use of a cord for the purpose of transmitting signals; but what I do claim is, the method of attaching the lines that operate the springs or weights, to the signal line, so that the engineer may be able to close all the brakes by said line, while the same line may be used for transmitting signals from the rear of the train to the engineer, without operating the brakes."

31. For an *Improvement in Manure and other Forks;* Benjamin H. Franklin, Worcester, Massachusetts.

"The nature of my invention consists in making the tines three sided, and so arranging them in the head or stock, as that one of the flat sides shall be on top, and the other two receding from the opening between the tines, which gives the fork on top an advantage of holding the material, whilst anything which slips through between the tines does not stick fast or choke on account of the widening of the space below."

Claim.—"What I claim is, making the tines of forks three sided, substantially as described, whereby I diminish the weight, retain the strength, improve the holding properties of the fork, and, at the same time, prevent its choking, and cheapen the article."

32. For an *Improvement in Grain and Grass Harvesters;* Uriah H. Goble, Springfield, Ohio.

Claim.—"What I claim is, 1st, Making the ground or driving wheel with a conical tread, to counteract the tendency of the machine to run into the uncut grain, to prevent the side draft, and to better balance the machine by throwing the heft to the outside, or from the uncut grain, substantially as described. I also claim so hinging the platform, immediately in rear of the cutters, and giving it a rising and falling motion by means of the cam and lever, or their equivalents, when said motions are made to conform to the motions of the reel or rake, to retain, and then facilitate the discharge of the cut grain from the platform in bunches, substantially as described."

33. For an *Improvement in Shoes to Winnowers;* Joseph Montgomery and Jas. Montgomery, Lancaster, Pennsylvania.

Claim.—"What we claim is, the construction and arrangement of the ordinary shoe, so as to receive an extra shoe and door, substantially in the manner and for the purpose set forth."

34. For an *Improvement in Manure Crushers and Sowers;* Thomas F. Nelson, Clarke County, Virginia.

"The nature of my invention consists in providing an attachment consisting of certain mechanical arrangements, which may be easily affixed to any seed planter intended for sowing wheat, or other grains or seeds, in drills, by means of which attachment, in combination with an ordinary seed planter, guano and other pulverized manures may be sown in the same furrow in which the seed is deposited, and at the same time. By my invention, the guano or other manures capable of, and requiring to be triturated, may be completely pulverized by the same power by which the seed is planted and the guano deposited."

Claim.—"What I claim is, the combination of the fluted or toothed cylinders with the toothed shaft, operating as described, for the purpose of grinding and distributing guano or other pulverized manures, in the manner set forth; the whole being in combination with an ordinary seed planter."

35. For an *Improvement in Grain and Grass Harvesters;* Wm. and Thomas Schnebly, City of New York.

"What we claim is, the method of arranging the gear, in combination with the movable plate, to which the crank pin is fastened, said movable plate being located on the flanch of the second pinion, by which method we can increase or diminish the lateral distance of the motion of the cutters, substantially as described. We claim the method of construct-

ing the hollow guard fingers, each one being a single piece only, substantially as described. Also, the self-acting rake with jointed fingers, in combination with the guide rods upon which it is made to slide back and forth, substantially as described."

36. For an *Improvement in Power Rakes;* Hiram N. Tripp, Alfred, Maine.

"While the rake is in use, should the attendant desire to throw the teeth off the ground, and thereby bring the wheels down upon the same, he has only to lift the back draft bar above the shoulder pieces, and lay hold of the back draft bar, and pull backwards on it, while the horse or animal in the thills draws forward. Such conjoint action of the man and beast operates to throw the rake teeth off the ground and up into a horizontal position, which position will be preserved while the bar is in front of and resting against the front ends of the shoulder pieces. In order to restore the teeth to their vertical positions, he lifts the bar above the front ends of the shoulder pieces, and pulls back on it while the horse draws forward. Thus, by the united actions of the man in rear of the rake and the animal in the thills, the operation of turning the rake head is effected."

Claim.—"What I claim is, the combining with the rake head and shafts, a set of levers and back draft bars, substantially as set forth, so that by the conjoint action of the forward draft of the horse and the back draft of the attendant, the rake may be either turned up or off the ground and supported on its wheels, or turned down so as to bring its teeth in contact with the ground, all essentially as specified."

37. For an *Improvement in Machines for Hulling and Scouring Coffee;* Robert P. Walker, City of New York.

Claim.—"What I claim is, the combination of the springing rubber flaps, or scourers and polishers, with the angularly set hullers or beaters, the whole being constructed and arranged in any equivalent manner to that described, and operating as set forth."

38. For an *Improvement in Cotton Presses;* J. B. Armstrong, Barnwell District, S. C.

Claim.—"What I claim is, the method described, of holding the bale under compression, and preventing it from springing or yielding during the stitching and roping of the same, whilst the platen is being run down or back by means of a false top or platen, hooked or otherwise hitched to the bed, and arranged to work in connexion with the main platen, substantially as specified, whereby time is economized in the operation of the press, as set forth."

39. For an *Improvement in Attaching Hooks and Eyes to Cards;* Charles Atwood, Birmingham, (Derby,) Connecticut.

Claim.—"I do not claim the crimping and perforating of cards with mortise-like holes for the purpose of attaching hooks and eyes to, as that was secured to me in a patent dated 25th September, 1819; but I do claim the crimped and perforated cards, combined with thread or thin splints, to fasten hooks and eyes to them, substantially as described. I claim, also, the attaching of hooks by the aid of a block, clamp, and cards, or by means substantially the same, as described."

40. For an *Improvement in Candle Mould Machines;* D. E. and M. Battershall, Troy, New York.

"The nature of our invention consists in the peculiar mode or manner of cutting, centring, and holding the wick tight in the moulds in readiness for use, by means of spring jaws, with cutter, centring plate, and holder, arranged on the top or face of the machine and moulds; also, a wick tightener arranged at the bottom of the machine."

Claim.—"What we claim is, 1st, The arrangement for cutting, for centring, and for holding the wicks at one and the same operation, by means of the cutter, guide plate, jaws, springs, tumblers, crank arms, connecting rods, horizontal sliding bar, pawl, eccentric plate, and vertical sliding bar, the respective parts being arranged and operating substantially in the manner and for the purposes as described. 2d, The wick tightener, constructed and operating substantially in the manner and for the purpose as described."

41. For a *Machine for Stamping Patterns on Rollers;* James Baxendale, Providence, Rhode Island.

Claim.—"What I claim is, stamping rollers for printing cotton or other textile fabrics by means of a punch, which is attached to a weighted arm or lever, raised by a cam, and allowed to fall on an elastic gauge at regular intervals of time, while the roller is moved in the direction in which the pattern is to be repeated, substantially as set forth."

42. For an *Improvement in Hot Air Furnaces;* James Bolton, M. D., Richmond, Va.

"The nature of my invention consists in driving an air chamber (surrounding a stove, furnace, pipe, or other contrivance by heating air,) by partitions into separate compartments, each of which is to be connected with one or more separate warm air flues, so that each flue or set of flues may be supplied with warm air from that compartment exclusively with which the flue or set of flues may be connected."

Claim.—"What I claim is, the division into compartments of the air chamber surrounding a stove, furnace, pipe, or other contrivance for warming the air which it contains, so that the warm air may be drawn off by flues from each compartment, without interfering with the supply of warm air from the other compartments."

43. For an *Improvement in Metallic Trunk Frames;* Lazare Cantel, City of N. York.

Claim.—"I do not intend to confine myself to the use of this frame with leather trunks, as it may be used with other characters of trunks, and with carpet bags, hat cases, or similar articles; neither do I confine myself to the frame being square, as other shapes and sizes may be used, as suited to the articles to which the frame is applied. I am aware that the strip or plate on three sides has been used; but I am not aware of any joint or frame having been made of a bent plate or strips with ribs and grooves, as specified. And I do not claim, in general, the metallic frames, made with tongues and grooves, and hinged together at one side for the joints of trunks; but I do claim forming the joints of trunks by arming the edges of the material of which the body is composed with sheet metal covering, crimped in the form of the tongues, as specified, whereby I obtain not only a protection to the surface from wear, but also the effect of a stiffening frame, as well as strength in the tongue, and that at a small expense."

44. For an *Improvement in Shuttles;* David Carroll, Baltimore, Maryland.

Claim.—"I would state that a close shuttle has been used for sewing cloth where a cap instead of a bobbin is employed; this I do not claim; but what I do claim therein as new is, in combination with the bobbin of an ordinary shuttle, the hinged guard projecting from and over the point towards the heel of the bobbin, for the purpose of preventing the thread or yarn, when paying off too fast, from looping or tying, substantially as described."

45. For an *Improvement in Car Brakes;* John d'Homergue, City of New York.

"The nature of my invention consists in the employment of hollow sheaves attached permanently to the middle of the axles, within each of which sheaves, and detached from it, is a system of cams, moved simultaneously, and made to press against the inner periphery of the rim of the sheave, making an effectual brake."

Claim.—"What I claim is, the described arrangement of the cams upon the blocks and within the sheaves, so as to press simultaneously against the inner periphery of said sheaves by the action of the tri-branched ring, substantially as set forth."

46. For an *Improvement in Soda Water Fountains;* Alexander Frankenberg, Columbus, Ohio.

Claim.—"What I claim is, the arrangement and combination of the stop cock apparatus with reservoirs, as set forth, and for the purpose described."

47. For a *Machine for Jointing Table Tops;* W. I. Hatfield, Dayton, Ohio.

Claim.—"What I claim is, the method described, of jointing and hinging tables by means of rotary cutters, arranged and operating substantially as specified, whereby time and labor are economized, and greater accuracy is insured, as set forth."

48. For an *Improvement in Processes for Vulcanizing Caoutchouc Compounds;* L. Otto P. Meyer, Newtown, Connecticut.

"The nature of my invention consists in producing, by means of oil and other fatty substances, smooth and glossy surfaces upon the material commonly known as the hard compound of vulcanized caoutchouc or gutta percha, or other vulcanizable gums, which may be manufactured according to the processes described in letters patent of the United States, granted to Chas. Goodyear, June 15, 1844, and Nelson Goodyear, May 6, 1851.

Claim.—"What I claim is, the producing of smooth and glossy surfaces upon the hard compounds of caoutchouc and other vulcanizable gums, by means of the use of oil or other equivalent substances, applied to the surface of the prepared gum, and between the gum and the plates of metal, or the moulds, substantially as described."

49. For an *Improvement in Hand Looms;* James A. Mitchell, Ringgold, Georgia.

Claim.—"What I claim is, the combination of the keys or pegs through the rods, levers, links, and springs, or their equivalents, with the treadles, substantially in the manner described, whereby I am enabled to operate the harness of hand looms by a movement of the fingers instead of the feet. I do not, however, claim the hand loom as generally constructed or used, or as operated by feet pedals, or treadles."

50. For a *Machine for Sawing and Planing Clap Boards;* Ephraim Parker, Rock Island, Illinois.

Claim.—"What I claim is, planing or dressing the insides of two clap boards at the same time, by means of the combination of the saw, parting guide, one cutter head, and the adjustable metallic beds; the above parts being arranged and operating substantially as shown and described."

51. For an *Improvement in Carriages with Shifting Seats;* Godfrey Simon, Reading, Pennsylvania; patented in England, March 4, 1853.

Claim.—"What I claim is, the manner described, of constructing, arranging, and applying or using the movable front seat, foot-board, and dash board, and of adapting the body of the carriage thereto, as described; but I make no claim to any of the said devices severally."

52. For a *Screw for Planking Ships;* Solon Staples, Topsham, Maine.

Claim.—"I do not claim the use of screws generally, in planking vessels; but what I do claim is, the combination of the shank, its arms and screw, with the brace, screw, and chain, constructed and combined substantially in the manner and for the purposes described."

53. For an *Improvement in Guides for Sewing on Binding;* Henry L. Sweet, Foxborough, Massachusetts.

Claim.—"What I claim is, the doubling guide, as not only made with a flat mouth, or one capable of receiving the ribbon, tape, or binding, in a flattened state, but with a bent channel or sides, such as shall gradually bend or double it, and discharge it at the other end in a double state, ready to be applied to any article conveniently placed to receive it, and leave it sewed thereon, as stated."

54. For an *Improvement in Horse Shoes;* William H. Lowers, Philadelphia, Penna.

"The nature of my invention consists in making the shoes with inclined flanches or lips, raising from the front and sides of its upper surface, corresponding in form with the parts of the hoof against which they are caused to bear, when fitted to the horse or other animal, one of which flanches is so constructed as to be capable of removal for fitting the shoe, and afterwards to be replaced and fastened by a screw, wedge, or other suitable equivalent, in such a manner as to secure the shoe firmly to the hoof without the aid of the nails heretofore employed for that purpose, which tend to split and weaken the hoof, and frequently penetrate the soft and sensitive parts of the foot."

Claim.—"I do not claim the employment of flanches or lips on the upper surface of the shoe; but what I do claim is, constructing the shoe with a detached flanch secured substantially as described, so that the side and front flanches shall firmly fasten the shoe to the hoof, as set forth."

55. For a *Machine to Cut Polygonal Surfaces in Timber;* Elias Unger, Dayton, Ohio.

Claim.—"I do not claim the movable table or the revolving face plate; neither do I claim the securing of timber between standards, as such are well known; but what I do claim is, securing the timber to be dressed between two clamps on traversing carriages, by means of eccentric pins, as described, so that the faces or surfaces dressed by the cutter, may have any desired angle with the axis of the piece, for the purposes and in the manner set forth."

56. For an *Improvement in Cleansing Hair and Feathers from Insects, &c.;* Wm. Wisdom, Cleveland, Ohio.

Claim.—"I disclaim to be the originator of sal soda as a purifying agent; but what I do claim is, purifying hair and feathers by destroying noxious insects or infectious matter contained therein, by subjecting the same to a vapor bath of chlorine gas, after the material has been cleaned by a bath of sal soda, in the manner and for the purpose specified."

57. For an *Improvement in Gold Pens;* Edmund H. Bard and Henry H. Wilson, Philadelphia, Pennsylvania.

Claim.—"We do not claim the employment of flat ribs, when composed of two pieces, as such pens have been heretofore made; but what we do claim is, the construction of metallic pens having the form of the semi-cylindrical barrel combined with the angular diverging planes, by compressing the metal between correspondingly shaped dies, substantially in the manner described."

58. For an *Improvement in Separating Alcohol from Water and other Heavier Fluids;* B. F. Greenough, Cincinnati, Ohio.

Claim.—"What I claim is, the separating of alcohol and its compounds of parts of different specific gravities, by means of the pressure of a column of such liquid, thereby causing what I denominate the 'hydrostatic displacement,' as set forth."

59. For a *Shingle Machine;* Benjamin F. Stevens and Walter Kidder, Lowell, Mass.

Claim.—"What we claim is, 1st, The combination of the movable side bars with the shaving knives and cams, arranged and operated as shown and described, for the purposes set forth. 2d, The combination of the sliding arms carrying the riving knife with the driver, for the purposes and in the manner set forth."

60. For an *Improvement in Folding Bureau or Wardrobe Bedsteads;* Andres Erich Botter, City of New York.

"The nature of my invention consists in a peculiar construction of the bedstead, whereby it may be folded or shut up when desired, so as to represent a wardrobe, book case, or a like piece of furniture. The bedstead, when unfolded, is partially supported by a rectangular chest or box, which may contain a child's crib, or drawers for clothing; said chest, when the bedstead is folded or shut up, being underneath the bedstead, and forming its only support, and serving to increase the height of the bedstead, so as to conform, as regards proportion, to the kind of furniture previously named."

Claim.—"I do not claim a bedstead arranged so that it can be closed or folded, and represent or imitate, when closed or folded, a bureau, or other piece of furniture, irrespective of the peculiar arrangement of the parts described; but what I do claim is, the peculiar construction of the bedstead, as shown, viz: having the two parts connected by hinges to a chest, by which construction the bedstead may be folded or shut up during the day, occupying but little room, and resembling a piece of room furniture, and unfolded at night when desired for use; the chest being provided either with drawers, or a crib for children, as set forth."

61. For an *Improvement in Self-Acting Machines for Weighing Grain;* Isaac D. Garlick, Lyons, New York.

Claim.—"What I claim is, 1st, The auxiliary gate, when combined with the loaded bent lever and cam catch, or their equivalents, which act upon the steelyard so as to lift shortly before the weight of grain in the weighing box becomes sufficient to raise it, substantially in the manner and for the purposes set forth. I also claim suspending the weighing box in the frame, by means of the rack, pinion, and loaded lever, whereby it is made to slide up and down within said frame at each weighing, and to produce the movements, substantially as described. I also claim the arrangement and combination of the bent cam lever, the pin on the frame, and the curved elastic rod, connecting said lever with the lid for the purpose of opening the lid at each descent of the weighing box within the frame, and again closing it by the ascent thereof, substantially in the manner set forth. I also claim the suspended hopper, in combination with the vibratory lever, arranged substantially in the manner and for the purposes set forth. I also claim the combination of the notches and catch wire with the elastic shoe and pin of the lever, arranged in such a manner that said lever is successively set free from the notch, catch, and notch, respectively by the ascent, descent, and second ascent of the steelyard, substantially as set forth. I also claim the adjustable cam catch, arranged substantially as described, in combination with the shouldered rod, for the purpose set forth. I also claim the slotted rod, in combination with the vibratory lever, when arranged in such a manner that the ascent of the lever will raise the gate and hook the catch over the pin of the steelyard, but will not disturb the gate in its descent, substantially as described. I also claim the arrangement and combination of the adjustable notched and perforated disk, the coupling pins, index, arm, and step, substantially in the manner and for the purposes set forth."

62. For an *Improvement in Steam Boilers;* Charles F. Sibbald, Philadelphia, Penna.

Claim.—"What I claim is, the fire box, deflecting plates, fire surface, and water surface, as constructed, and the whole arranged as set forth. And I also claim the additional steam chamber placed below the water surface, and behind the fire-box, and connected to the main steam chamber by a pipe passing through the smoke stack, as set forth."

63. For an *Improvement in Sewing Machines;* Sherburne C. Blodgett, Georgetown, Assignor to Charles Morey, and Morey Assignor to Nehemiah Hunt, Boston, Mass.

Claim.—"I do not limit it to the employment of all or either of such mechanical contrivances for moving either of the needles or the cloth, as I have specified, as others, well known as mechanical equivalents, may be substituted for them; neither do I confine my improvement to the precise form or forms of arrangement or arrangements of all or any of its parts, as circumstances may vary the same without changing the nature of the invention. What I claim is, the formation of sewing, in cloth or other material, by the interlooping of two threads by the conjoint action of two needles, in such manner that each needle shall be made to carry a loop of thread through a loop formed by the other needle, and through the cloth, whereby one thread serves as a binding thread to the other, substantially in the manner described."

64. For an *Improvement in Time Registers for Showing the Day of the Week and Month;* Wm. H. Akin, Assignor to Wm. J. Huntington, Ithaca, New York.

Claim.—"What I claim is, 1st, The particular arrangement of the months with their appropriate number of days, as described, on the paper, and for the purposes described; commencing Feb. 1st, Feb. 2d, Feb. 3d, and so on for 28 days only, and then all of the other months in their regular order, with their appropriate number of days for the whole year, (with the February first mentioned, and having the 28 days.) Then, again, February having 29 days, and also 8 or 10 days of another, March, at the last end of the paper, and within which 8 or 10 days the machine must be wound up every bisextile or leap year, and requiring to be wound up in the first, second, and third years after leap year, during February having the 29 days, and before the 29th day thereof. 2d, The arrangement and combined action of the rollers, showing the day of the week and drawing up the paper, exhibiting the month and days of the month in their regular order, substantially as set forth; the paper, after it is drawn between the rollers, being disposed of by winding it upon the rollers by means of a weight or spring, as described."

65. For an *Improvement in Pick Axes;* John C Concklin, Peekskill, Assignor to Dan. Tomkins, North Harverstraw, N. Y., and Daniel F. Tompkins, City of New York.

Claim.—"I do not claim the extending of the main bar through the centre of the eye of the pick axe; neither do I claim the braces which secure the handle; but what I do claim is, the combination of the said bar with the braces and the loops, substantially in the manner and for the purposes set forth."

66. For a *Machine for Folding Seidlitz Powders;* Wm. A. Martin, Brooklyn, N. Y., Assignor to W. Watson and Peter Van Zandt, City of New York.

Claim.—"What I claim is, 1st, The bars, and moved by the means shown, or any analogous device, for folding the paper in the manner specified. 2d, The frame with its cutters and blocks, in combination with the beds on which the paper lies, to divide the papers containing the powder, and fold the ends against the ends of the blocks, as described."

[The following patent was accidentally omitted in the publication of the 6th Dec., 1853.]

67. For an *Improvement in Grain Harvesters and Binders;* Peter H. Watson and Edward S. Renwick, Washington, D. C.; dated Dec. 6, 1853; ante-dated June 6, 1853.

Claim.—"What we claim is, 1st, The combination of a continuously acting rake with a binding mechanism, acting intermittently, substantially as set forth, which, among other things, gives the director of the machine an opportunity to observe the rate at which the grain for each sheaf is accumulating, so that by hastening or retarding the operation of the binding mechanism by shifting the belt on the cone pulleys, he can make the sheafs nearly of uniform size. 2d, The method of compressing the loose grain into sheafs vertically, instead of horizontally, whereby, among other advantages, the lateral dimensions of the machine are considerably diminished, which adapts it the better to running between stones and other obstructions, and enables it to cut the outside swath round a field with

less trampling and waste of the grain. 3d, The shifting conveyor, by means of which sheafs of varying length may be bound round the middle, without changing the relative positions of the cutting and tying machine, substantially as set forth. 4th, The combination, in a grain harvester, of two series of bands, one or both armed with teeth, for the purpose of carrying the grain to the binder, as set forth. 5th, The combination of a shifting stripper, with a conveyor, substantially as set forth. 6th, The combination of the discharging gate, or the equivalent thereof, with the receiving platform and the binding crib, substantially as set forth. 7th, The traveling cord nippers, or their equivalents, operating substantially as set forth. 8th, The combination of the cord with the cord feeder, substantially as set forth. 9th, The method of drawing the binding cord round the sheaf with the proper degree of tightness preparatory to tying, by means of a spring operating upon the cord spool, substantially as set forth. 10th, The traversing movement of the tying forceps in alternately opposite directions, in combination with their opening and closing movements, whereby the two ends of the band may be laid together, and may then be grasped by the forceps to be tied, thus dispensing with a finger to thread the cord through the eye of the forceps. 11th, The pronged standard, in combination with the tying forceps and the finger, or their equivalents. 12th, The method of rendering slack cord to facilitate the tying of the band by lessening the diameter of the sheaf as the cord is taken up in making the knot. 13th, The arrangement of the cord nippers upon a sliding stock, pressed down by a spring which yields to allow the stock to stand still while the compresser which carries it is moving, substantially as set forth. 14th, The retarding of the cord by means of a brake, or the equivalent thereof, applied to some point between the place at which the knot is tied, and the extremities of the cord, to ensure the stretching of its ends across the loop, preparatory to their projection through it in the operation of tying the knot, substantially as set forth. 15th, The arrangement of the sides and bottom of the binding crib, so that it can be depressed to permit the discharge of the sheaf, substantially as described. 16th, The arrangement of the cutting and binding mechanism on opposite sides of the driving wheel, substantially in the manner and for the purposes set forth."

Designs for December, 1853.

1. For *Cooking Stove;* Winslow Ames, Nashua, New Hampshire, Assignor to Hartshorn, Ames & Co., Boston, Massachusetts, December 20.

Claim.—"I claim the ornamental design of the side plate of the body of the stove, and of each of the larger and smaller doors, of either of the front or side plates."

2. For *Parlor Stove;* James Wager, Volney Richmond, and Harvey Smith, Troy, New York, December 20.

Claim.—"What we claim is, the ornamental design and configuration of parlor stove plates, such as described."

3. For a *Cylinder Coal Stove;* James Wager, Volney Richmond, and Harvey Smith, Troy, New York, December 20.

Claim.—"What we claim is, the design and configuration of the plates as described."

JANUARY 3, 1854.

1. For a *Machine for Sawing Bevel Surfaces;* Alfred C. Cook, Russellville, Ky.

"The nature of my invention consists in an adjustable swinging bevel, gauging platform or bench, which is supported by a strong stationary frame, the top of said platform serving as a carriage for feeding the stuff in an angular or straight direction, up to a saw passing up through and working in a long slit in the carriage, as it is moved back and forth, over the adjustable platform. The guide pieces or side rails of this carriage being made adjustable to allow the platform to be adjusted to suit any description of bevel desired to be cut. And the side-rest and dog against which the stuff lays or rests, being also adjustable so as to cut any desired flare, or give the stuff any angle lengthwise that may be desired. The shaft upon which this platform swings being provided with a needle or index pointer on one of its square ends, which pointer is moved to a certain number on an index plate, attached to one end of the stationary frame, as the platform is adjusted to

give a certain bevel, the said plate or index scale being set to suit the kind of work being done, and can be marked out so as to indicate any angle or bevel from a right angle to any angle desired."

Claim.—"What I claim is, the employment in the manner herein described of an adjustable swinging bevel gauging platform, provided with a sliding carriage, which has adjustable guide rails, and adjustable heel and side rest, and pointer, in combination with an index plate and cutter, the whole being constructed, arranged, and operating in the manner and for the purpose herein described."

2. For *Improvements in Feathering Paddle Wheels;* Samuel Champion and Thomas Champion, Washington, D. C.

Claim.—"We claim no particular shaped blades for our paddles, as various shapes may be used; but, as a general principle, we prefer, where it can be applied, the narrow, oar-shaped blade, reaching deep into the denser water, so as to make the engine labor in forcing it through, without much disturbing the surface. We are encouraged in this view by the narrow oar, the fins of the fish, and particularly by the long, deep propellers of the deer, that animal being among the very fastest of swimmers as well as of runners. In making these blades, we would propose as the best material, wrought iron or steel, or both, with the oblong button or guide at the shank end of the blade, forged solid, the blade next thereto being round, or nearly so, thence outwardly being flattened and widened, leaving the centre the thickest and strongest, by which means great strength will be attained. It is obvious, that various modifications may be made in the construction of this propeller without departing from the principle of our invention, and we also propose to use it either as partially or wholly submerged. What we claim is, the continuous arm or arms through the shaft, hub, or rim, with a blade on each end thereof, placed permanently at right angles to each other, so that when one is feathered in the water, the other is placed in proper position for propulsion by that act, also the reversing cam frame in combination with the oblong projections at the shank of the blades."

3. For an *Improvement in Running Gear of Wagons, &c.;* Isaac Crandal, Cherry Valley, New York.

Claim—"I am aware that Jonn Jones obtained a patent, dated January 14, 1851, which by the introduction of a helical spring and slot, or sliding bar, connecting the hounds or partial reaches (between the front and rear axles) in connexion with his perch swiveling on both axles, purposes to prevent the effect of whipping the horses with the tongue, and drawing it back to the line of travel when moved. I therefore disclaim any part of such devices as he uses. But what I do claim is, the arrangement of the spring bar, (or partial reach,) furnished with a slot, the bar connecting the sand bar and upper sway bar, in which is inserted the pin, in combination with the ordinary reach or perch and running gear of wagons, for the purpose of not only giving direction and steadiness of the tongue under all circumstances, but also preserving the set of the axle at the same time, as set forth and shown."

4. For a *Ruling Machine;* John Collmann, Silver Creek, Illinois.

"My invention refers to an improvement in machines for ruling parallel lines upon copper plates and other surfaces, and has for its object the moving laterally of the way upon which the ruling carriage runs; it consists in moving the box, to which this way is attached, along a bar passing through it, by the action of a cam working against a plate alternately sliding upon and secured to the traversing bar, the operation being peformed by means of a lever fastened to the cam, the movement of which is regulated by an adjustable stop, thus limiting the advance of the box, and regulating the distance between the lines."

Claim.—"What I claim is, the case alternately sliding upon and secured to the bar, as specified, in combination with the cam, lever, spring, and stop, arranged and operating as described, for moving the box upon the traversing bar any required distance, substantially as and for the purpose set forth."

5. For an *Improvement in Straw Cutters;* William S. Dillehay, Shelby county, Ky.

Claim.—"What I claim is, the diagonal knife with two edges, in combination with the movable scraper with its proper appendages, and the manner of its movements parallel with the edges of the knife, thereby cleansing the gauge table of all the cut straw. The double arm crank, and the other cranks, fly wheel, and pitmans, I do not claim; they have been long known to mechanics."

6. For a *Method of Forming Plates for Poly-Chromatic Printing;* John Donlevy, City of New York.

Claim.—"What I claim is, the method of producing intagliographic printing, and other plates, from forms of types, by surrounding the types whilst in contact with a glass plate or its equivalent, with plaster of paris, or some equivalent therefor, so that when set, the surface of the plaster will be on the same plane with the surface of the types, and then stereotyping the form of types thus surrounded, substantially as and for the purpose specified. I also claim the method of producing embossing plates by taking a cast, in plaster or its equivalent, from an intagliographic plate, and then stereotyping such plaster cast substantially as specified, thus producing a reverse duplicate in relief, as set forth. I also claim the method of producing what are called illuminated printing plates, for printing shaded intagliographic letters, characters, or figures, by producing an intagliographic plate, in accordance with the first part of my invention, from a form of shaded types, and then removing the plaster from the form of types, substantially as described, so that after printing in intaglio with the intagliographic plate, the shadows can be printed either with the form of types after the plaster has been removed, or with a stereotype taken therefrom, as set forth: and finally, I claim producing poly-chromatic printing plates from an intagliographic plate, by taking a cast therefrom in relief substantially as described, and from such relief obtaining what I term 'stencil plate or plates,' from which the plate or plates is or are obtained, to have the letters, characters, or figures, in whole or in part, in duplicate of the intagliographic letters, &c., and in relief substantially as described, so as to register therewith, as described."

7. For an *Improvement in Steam Boiler Furnaces;* F. P. Dimpfel, Philadelphia, Pennsylvania.

Claim.—"I do not claim lining the fire box with water tubes, nor do I claim making the tubes of water linings separately detachable; but I do claim forming the walls or sides of the furnaces of steam boilers, of a series of water tubes extending above and below the grate, and open to water spaces above and below, said spaces being so connected with each other, or with the body of the water in the boiler, as to allow free circulation, in the manner substantially and for the purposes set forth."

8. For an *Improvement in Quartz Crushing Machines;* James Hamilton, City of New York.

Claim.—"I do not claim the cylindrical pestle, or roller, in itself, as it has been used on a flat surface, and I am also aware that the cylindrical pestle has been used in a concave dish, or basin, but in this case, so far as the rolling motion is concerned, the same operates similarly to the ordinary rollers in oil mills, &c., but the sliding motion is dependent on the weight of the pestle, causing the same to slip on the inclined part and rub the ore; whereas, in my machine the ore is first cracked by the grooved upper surface of the pestle, which I am not aware has ever been before used, and the grinding is performed by a pestle set on a shaft, and having a partial rotary motion, which grinds the ore against the sides of the basin, without having any rolling motion at all; therefore, what I claim is, the means described and shown for cracking and grinding metallic ores, consisting of the cylindrical pestle, provided with grooves in its upper part to crack the lumps of ore, and set on a shaft, on which it has a partial rotary motion, and operating in connexion with the basin, in which said pestle moves to grind the ore into powder by the gradual approach of the sides of said basin to the cylindrical pestle, said pestle being also provided with a scraper or agitator in its lower surface, to operate as specified."

9. For an *Improved Method of Hanging and Operating Saw Gates;* Michael W. Helton, Bloomington, Indiana.

"The nature of my invention consists in so hanging a pair of gates, the saws of which operate in the same log, as to be self-balancing, the weight of said gates coming upon a fixed pivot or pin, and not upon the pitman, although the pitman gives them motion, and also the method of operating the gates by a pitman hinged and pivoted at its upper end, and moving in a circular plane at its lower end by a bent crank or otherwise, so as to oscillate the gates, without sustaining their weight."

Claim.—"What I claim is, the driving of the pairs of saw gates, the saws of which operate in the same log by means of a bifurcated pitman, hinged to the rocking cross beam by its two arms, and connected by a wrist upon its other end, with the crank of the driving shaft, by which means a conical gyratory motion is imparted to the pitman, for the purpose and substantially in the manner described."

10. For an *Improvement in Tuyeres;* George D. Miller, New Berlin, Pennsylvania.

Claim.—"I do not claim the chamber, passage, outlet, or valve, as such are well known; neither do I claim an additional outlet when governed by an additional cock or valve: but what I do claim is, the combination of the notched segment of cylinder, with the egress passages, and for regulating and changing the direction of the blast, substantially as set forth, when the apparatus is constructed with the additional passage."

11. For an *Improvement in Screw Bolts and Nuts;* Lucius Paige, Cavendish, Vt.

Claim.—"I do not claim the invention of a ratchet wheel and holding pawl and catch, as commonly made and applied to prevent back rotation of a wheel revolving on a shaft; but what I do claim is, the forming of a helical thread of a male screw, with notches or teeth, as specified, in combination with applying to its screw nut a dog catch or spring pawl to operate in the said teeth or notches, and prevent back rotation of the nut on the screw, substantially as set forth. I also claim the improvement of so applying the catch lever or dog, or catch to the nut, that it may project beyond one prismatic side of the nut, so that when a wrench is applied to such side of the nut and its opposite side, it may press inwards the dog, or catch, or lever thereof, or so act upon the same as to throw such dog or catch out of engagement with the teeth or notches of the male screw, so as to allow the nut to be unscrewed from the same, substantially as specified."

12. For a *Machine for Cutting Irregular Forms;* Jonathan Russell, Philadelphia, Pa.

Claim.—"What I claim is, so combining the spur wheel on the mandrel which directs the pattern, and the spur wheels for controlling the rough material with the main wheel, which moves or turns them through their respective carriages, as that the carriage which carries the pattern may have an uniform or differential advancing and receding longitudinal motion relatively, with regard to the carriage for carrying the rough material for the purpose of cutting to the same, or to a greater or less size than the pattern, substantially as described. I also claim hanging the tracers in independent frames, within the frames which carry the cutters, so as to allow the cutters to bring the rough material to the same, a greater or less size than the pattern in its transverse diameter, substantially as described. I also claim giving to the pattern and rough material, a half or less than a half revolution at each traversing motion of their respective carriages, for the purpose of cutting or reducing in longitudinal sections, without revolving the pattern or rough material, substantially as described."

13. For an *Improvement in Floor Plates and Malt Kilns;* Mathew Stewart, Philadelphia, Pennsylvania.

Claim.—"I do not claim the use of perforated sheet or plate iron in the construction of malt kiln floors; but what I claim is, 1st, The characteristic mode in which I construct the plates, with downward edges, at right angles with the surface of the plate, substantially and for the purpose as described; 2d, I claim the bearing and combining block, with the peculiar arrangement of the slots or grooves, or its equivalent, substantially and for the purpose as described; 3d, I claim the combination of the plates with the bearing and combining blocks, or its equivalent, and the peculiar manner of securing the plates and blocks down to the wrought iron bars by means of the wire holes in the vertical edges of the plates, or their equivalents, substantially and for the purpose as described."

14. For an *Improvement in Hot Air Registers;* Edward A. Tuttle, Williamsburgh, New York.

"The nature of my invention consists in the new and improved method of operating the valves of said registers and ventilators by an entirely new arrangement of the connecting rod, and its method of connexion with the fans or valves, which greatly simplifies and cheapens the construction of the register, while it is at these points more secure and equally strong."

Claim.—"I do not claim the rack and pinion movement or the crown wheel and segments; but what I do claim is, the improvement upon said William Turton's Patent Register, which consists in the improved method of maintaining the connecting rod in its proper position, substantially as described, namely, at the bottom, by a prong or prongs of the rod inserted into and working in cast raised openings on the fans or valves, and at the top by a slot or otherwise in the register front, together with the slide plate, by which arrangement the register is greatly simplified and cheapened in its cost."

15. For an *Improvement in Machines for Sticking Pins;* John B. Terry, Hartford, Connecticut.

Claim.—"What I claim is, the circular guard and circular slide, in combination with the wheel and spring, or its equivalent, whereby the pins are brought from the conductor, and dropped at the required place, as described."

16. For an *Improvement in Lowering, Raising, and Fastening Carriage Tops;* Zina S. Ogden, Assignor to Lewis C. Ogden, Glenn's Falls, New York.

Claim.—"What I claim is, the application of the lever, the shafts, eccentric circles, hooks, and the two bolts, to lower, raise and fasten carriage tops, with stationary bows, as described."

17. For an *Improved Mode of Banding Pulleys for Saws;* Dexter H. Chamberlain, Assignor to himself and Nehemiah Hunt, Boston, Massachusetts.

Claim.—"I do not claim the combination of three pulleys, (viz: a driving pulley and two others,) and an endless belt; nor do I claim the application and arrangement of such wherein the belt runs against or on the periphery of the driving pulley or wheel, and is strained between the two pulleys, and pinched between them and the driving pulley; nor do I claim an arrangement wherein one of the driven pulleys or rollers is placed between and in contact with the peripheries of the driving and other driven pulleys, while the endless belt is made to play around the two external pulleys, whereby the axles or journals of the driving and driven pulleys are relieved from friction caused by the contractile power or strain of the band, such strain being borne by the pulleys. But what I do claim is, my improved arrangement of pulleys and endless belt, whereby the driven pulley is sustained on the periphery of the driving wheel or pulley, the same consisting in placing the peripheries of the two lesser pulleys in contact with the periphery of the driving wheel, and so as to extend beyond the side thereof, and running the endless belt around the extensions of the said two pulleys, and down by the side of the driving wheel, and without any pressure or contact with its periphery, the whole being substantially as specified. And I also claim the combination of two endless belts, (arranged on opposite sides of the driving wheel,) with the bearing and belt pulleys, or their equivalents, and the driving wheel, as made to operate together, substantially as described, the same enabling me to relieve the bearings of the shafts of the several pulleys from the contractile strain of the belts. And I also claim the improvement of arranging two or more endless belts on one side of the driving wheel, and not only running all of the said belts around one shaft or drum, (or the equivalents,) supported on the periphery of the driving wheel, but respectively around other shafts, or drums, or equivalents, arranged and supported on the opposite portion of the periphery thereof, the whole being as specified."

18. For an *Improvement in Drying Book-Binder's Boards;* James H. Longbotham, Brooklyn, New York.

Claim.—"What I claim is, the use of the drying box, or chamber, endless belts for carrying the paper boards, coil of pipes arranged therein, in combination with a blower and case, having a series of coils of pipes therein for rarifying currents of air for drying book-binder's paper boards, and other substances, substantially as set forth."

19. For an *Improvement in Corn Shellers;* George A. Xander, Hamburg, Penn'a.

Claim.—"What I claim is, the improvement on the cylinder disk—that is, its oval shape, the spring being attached to the side, all as set forth. I would further state, that by riveting two half cylinders together, the cylinder may as readily be constructed double, and should I find it more practicable so to construct them, I do therefore not limit my claim merely to the single, but also the double cylinder."

20. For an *Improvement in Machines for Casting Type;* Charles Muller, City of New York.

Claim.—"What I claim is, 1st, Suspending the mould below its axis, or oscillation, substantially as described, whereby its tendency towards its centre of gravity will act in opposition to the momentum required in its movements towards and from the mould, and its movement and degree of opening are enabled to be reduced, producing the results set forth; 2d, the combination of the cam, lever, rod, lever, and rod, arranged substantially as shown, for the purpose of opening and closing the mould; 3d, filling the matrix by means of the lever, attached to the oscillating mould arm, combined as described with the lever, which receives an oscillating motion from the arm or lever, by which the oscillating motion is given to the shaft or axis upon which the mould oscillates."

21. For an *Improvement in Bedstead Fastenings;* William H. Price, Philadelphia, Pennsylvania.

Claim.—"What I claim is, the arrangement of the tenon, mortise, and wedge, in such a manner that the wedge will begin to act before the tenon is inserted in the mortise, and draw it gradually into said mortise, so as to completely close it when the fastening becomes firm, for the purpose of excluding vermin, and for other purposes set forth."

22. For an *Improvement in Machines for Polishing Leather;* Philip P. Tapley, Lynn, Massachusetts.

Claim—"I claim the described combination and arrangement of the crank wheel, the connecting rod, the swing bar, the lever, and the connecting rod, and also the improvement of making the connecting rod in two parts jointed together, and to operate as specified, whereby the contact of the dicing or polishing ball, or surface, with the leather, is prolonged under circumstances as stated."

23. For an *Improvement in Guitars;* William B. Tilton, City of New York.

Claim.—"I do not claim extending the strings from the foot to the head of the instrument; but what I do claim is, depressing the strings of guitars slightly below the bridge by passing them through perforations in the ordinary pins or pegs, or by any means substantially the same, when the strings are fastened at the foot of the instrument for causing the bridge to act as a fulcrum in producing the tension of the strings, and so relieving the sound board, as to give the instrument a richer, fuller, and a more complete tone, as set forth."

24. For an *Apparatus for Turning the Leaves of Books;* Claude Desbeaux, Paris, France.

Claim.—"I desire it to be understood that the present invention consists, 1st, in the principle of turning mechanically the leaves of music or other books, by means of a magnet and a piece of metal fixed or attached to the said leaves; 2d, in the mode described of moving this magnet, by the combination of which a good and convenient working of the system results; 3d, in the accessories which complete the said mode. I do not confine myself to the dimensions above mentioned, but I reserve to myself the construction above mentioned, of any material and of any dimensions, the placing of the pulleys vertically or horizontally. I may find it desirable to make the boxes of the "turn-pages" of wood, or of metal, according to the circumstances, to cover or not to cover them with cloth or leather, to use wood or metal, in the construction of the stands, to produce the lengthening or shortening by means of rack gearing or of levers, to change the relative proportions of the pieces, if necessary, to make the stamps or disks of polished or damaskined metal; in conclusion, to modify the details of construction on such limits which do not change the nature of my invention of the "magnetic turn-page," as set forth."

25. For an *Improvement in Power Looms;* John Shuttleworth, Frankford, Penn'a.

Claim.—"What I claim is, 1st, the connecting rod and lever, in combination with the reciprocating frame, for the purpose of giving a reciprocating motion and a rocking motion to the shaft; 2d, I claim the rocking shaft, arm, the vibrating lever, and arms, in combination with the reciprocating frame, for the purpose of giving an intermittent rotary motion to the wheel and disks; 3d, I claim the disks, constructed as described, in combination with the horizontal sliding stops, for the purpose of forcing out and drawing in said stops, in the manner described, and also for the purpose of operating the picker bar, substantially as described."

26. For an *Improved Arrangement for Cutting Screws in Lathes;* Joseph Nason, City of New York.

Claim.—"What I claim is, 1st, the mode of constructing and combining the stud, the tube, and the guide screw, by which guide screws of the various patterns used in screw cutting may be put on or taken off expeditiously; 2d, the mode of constructing the tool bearer generally, particularly as regards placing the slide rest behind the work, whereby the cutting tool is brought into such relative position with the shaft and the mandrel, that the operation of raising the tool bearer from the rail removes the tool from the work; 3d, the tool-lifter, constructed substantially as described, and employed for the purposes and in the manner specified; 4th, the combination of the guide screw, the threaded block, and the tool bearer, with the shaft, substantially as set forth, by which (1) the requisite traversing motion is imparted to the cutting tool; (2) the operations of releasing the block from the

guide screw, and removing the tool from the work, are simultaneously performed; and (3) the tool bearer may be turned back out of the way, when not in use."

27. For an *Improvement in Shanks of Hay and Manure Forks;* Reuben M. Hine, Mentz, Assignor to Horace C. Silsby, Seneca Falls, and Reuben M. Hine, Mentz, New York.

Claim.—"What I claim is, the fork, with the upper part of its prongs and its tang, constructed as here described, in combination with the ferrule, with sockets, and slot, as described."

28. For an *Improvement in Machines for Sticking Pins;* Thomas W. Harvey, City of New York, Assignor to John B. Terry, Hartford, Connecticut.

Claim.—"What I claim is, allowing one pin at a time to pass down the conductor by means of a vibrating slide or its equivalent, so as to supply one row of pins at a time by the conductors to the forceps, as specified."

29. For an *Improvement in Hemming and Cording Umbrella Covers;* Sherburn C. Blodget, Philadelphia, Pennsylvania.

Claim.—"What I claim is, the guide for cording or hemming umbrella covers, arranged upon a stand with a curved slot, to fold the hem around the cord, and a hole through which the cord is passed to its place; and this I claim, whether the guide be used alone or attached to a sewing machine."

30. For an *Improvement in Regulating the Damper of Steam Boilers by the Pressure of the Steam;* Patrick Clark, Rahway, New Jersey.

Claim.—"I do not claim operating the damper of a steam boiler fire by means of the pressure of the steam in a boiler; nor do I claim to have invented the diaphragm, nor its use to avoid friction, where fluid pressure is used to produce motion. What I do claim is, the combination of a cylindrical diaphragm, with a cylinder and piston, for the purpose of operating the damper of a boiler fire by means of the pressure of the steam."

31. For an *Improvement in Quartz Pulverizer;* Robert H. Collyer, San Francisco, California.

Claim.—"What I claim is, the arrangement of the cylinder-curved basin, vibrating arm, connecting rod, and power wheel attached to it, by which arrangement the cylinder is operated as a pulverizer and triturator, without a fixed shaft, as set forth."

32. For an *Improvement in Double-Acting Spring Hinges;* Theodore F. Engelbrecht, City of New York.

Claim.—"What I claim is, the combination of the two independent spindles, having right and left graduated slots in their sides, and against the stops of which the pins passing through the barrel of the hinge acts to operate alternately either of the springs attached to the spindles, as the door is opened outwards or inwards, with the barrel of the hinge, having flanches at opposite sides of the barrel, substantially as set forth."

33. For an *Improvement in Corn Shellers;* Banford Gilbert, Pittsburgh, Penn'a.

Claim.—"I do not claim as new the use of the feeding apron, nor the use of the toothed cylinder, or screw, separately considered; but what I do claim is, the constructing of the teeth on the cylinder and concave bed of the peculiar form described, and arranging the same in curved rows, so that during the revolution of the cylinder, the concavity of the rows of teeth on the cylinder meets the concavity of the rows of teeth on the concave bed, in combination with the screen or separator, and the self-adjusting concave bed, in the manner and for the purpose set forth."

34. For an *Improvement in Breech-Loading Fire Arms;* J. Durell Greene, Cambridge, Massachusetts.

Claim.—"I am aware that fire arms have been constructed in which the breech was forced up to its barrel by means of a screw cut upon its surface, and working in a female screw in the rear of the barrel; but as the breech required to make several turns, in order to advance it sufficiently to force it against the barrel, it was not practicable to adapt a lever to it for the purpose of operating it, which was effected by the thumb and finger, and required considerable time to accomplish it. The force that could therefore be brought to bear upon the breech was not sufficient to ensure a tight joint at its junction with the barrel, and the contrivance has failed to accomplish the desired end; I am also aware that Benjamin Chambers has obtained a patent for a movable breech secured to its

barrel by means of a divided screw upon its advance end, and working into a corresponding screw in the rear end of the barrel; I therefore claim neither of these devices, and only seek a patent for an improvement on the invention of the said Chambers; but what I do claim is, the combination of the movable breech with the revolving chamber, when the two are connected together by means of the divided screws, in the manner set forth, the whole being constructed and operating substantially as described."

35. For an *Improvement in Machines for Nailing Washboards;* James B. Holmes, Cincinnati, Ohio.

Claim.—"What I claim is, the use or application, substantially as set forth, of a percussion force, actuated by power to nail and clamp together the parts of a washboard, in the manner substantially as set forth."

36. For an *Improvement in Corn Planters;* Samuel Malone, Fremont, Illinois.

Claim.—"What I claim is, the peculiar construction of the horizontal slide, made reversible from end to end, for the purpose of varying thè quantity of seed planted, in the manner set forth."

37. For an *Improved Ratchet Catch for Head Blocks in Saw Mills;* George F. Page, Baltimore, Maryland.

Claim.—"What I claim is, the combination of the latch, catch, and escapement pawl, in the manner and for the purposes set forth."

38. For a *Machine for Cutting Hand Rails;* Thomas Rogers, Philadelphia, Penn'a.

Claim.—"I do not claim pulleys, bands, worm wheels, or pinions, being aware that they have been used before in machinery; but I do claim the combination of the self-adjustable cutters, (reversible in motion as described,) with the jointed shaft, and devices for driving the same, in the manner and for the purpose set forth."

39. For an *Improvement in Sealing Preserve Cans;* Henry C. Nicholson and James Spratt, Cincinnati, Ohio.

Claim.—"What we claim is, the application to the aperture of a preserving vessel, of a disk, strip, or pellet of gum elastic, (or other pliant and air-tight substance,) in combination with a wire as described, or its equivalent, at the foot of the pump or tube through which the exhaust is made, whereby the said disk or pellet, being temporarily confined in its range of motion, performs the service of a valve during the exhaustion or escape of the atmospheric contents, and afterwards that of a stopper; and this we claim, whether applied or not in connexion, as described, with cement on the inner surface of the disk, for the self-sealing thereof."

40. For an *Improvement in Machinery for Sawing Logs;* Oren Stoddard, Busti, N.Y.

Claim.—"I do not intend to limit myself to the sizes or proportions of the parts, as these may be varied to suit the size of log to be operated on, and the parts of the frame, &c., may be either wood or metal, and can be so fitted as to be taken apart for transportation, and can be set up in a forest and driven by horse power, so as to prepare logs for the market directly on the spot. What I claim is, 1st, The means herein set forth for elevating the saw when it has cut through the log, by means of the ratchet pawl, lever, and parts attached, in combination with the retaining latch, operated upon by the log, when it has been forced forward the required amount to disengage said latch, and allow the saw to operate on the log, as set forth. 2d, I claim forcing the log along the required amount for each section to be sawn off by means of the roller, operated on by the lever and pawl, when said pawl is brought into action by the lever, as specified."

41. For *Improvements in Operating Cut-off Valves in Steam Engines;* Wm. Wright, Hartford, Connecticut.

Claim.—"I do not wish to limit myself to the use of the adjusting cams, in connexion with the fly-ball governor, as the position of the shaft can be regulated by hand, or by any other kind of governor; nor do I wish to be understood as limiting myself to the employment of my invention for operating puppet valves, as other valves, whether sliding or otherwise, may be operated by the same means; nor do I wish to limit myself to the special construction of the parts, so long as the same end is attained by the mere substitution of equivalents. I am aware that the cut-off valves of steam engines have been operated by cams, made in a helical form, to vary the period of closing by sliding the cam endwise; and, therefore, I do not claim, broadly, the use of the shifting cam for this

purpose; what I claim is, the employment of the rotating concentric hub, on which the toes, or their equivalents, of the lifters, rest, when the valves are closed, substantially as specified, when this is combined with a cam connected therewith, and which turns eccentrically thereon, for the purpose of opening and closing the valve, and regulating the period of closing the same, substantially as specified. And I also claim combining with the said hub and cam, a slide within them, and acting on an oblique groove within the cam, and a straight slot in the hub, substantially as specified, to determine the period of closing the valve, whilst the period of opening remains the same, as specified; and this I claim, whether the said slide be operated by a governor, or by other means.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Improved Apparatus for the Analysis of Coal, and for Organic Analysis generally. By J. H. Alexander and Campbell Morfit.

Early in October last, having to make an ultimate analysis of divers specimens of coal, anthracite and bituminous, we had also abundant opportunity of observing the want of certainty and uniformity of result in the methods ordinarily recommended and practised for such analysis. With all these methods, where the aim is to induce the organic or other substance under analysis to give off its carbon by combustion, in glass tubes, with oxide of copper, chromate of lead, or chlorate of potassa, either separately or mixed; and where the effects arise under a simple play of affinities at a high temperature, and are unaided by any external force or mechanical agency, variations occur to such an extent, as, in the case of anthracite coal especially, to leave the results, from several assays of the same sample, rarely identical. We have found these variations to depend, among other things, upon the grade of comminution of the matter for analysis, and its mode of intermixture with the oxidizing agents. If, for instance, the coal is too finely divided, it either protects, or is protected by the re-agents against the effect of the heat; although this may be so high as to fuse the tube and part of its contents. If, on the other hand, the coal be not finely divided enough, it protects itself. We all know the extreme difficulty of driving off the carbon from an anthracite coal, for example, even in an open crucible and over a blast; where sometimes three hours and more are spent in reducing so small a quantity as one gramme to ashes. And as for the mode of intermixture which shall be most favorable for the exposure and contact of the greatest amount of surface between the material and re-agent respectively, it is easy to see that, even after having been studied and attained in one instance, its repetition must be more the gift of good fortune than the result of any regular and unfailing manipulation.

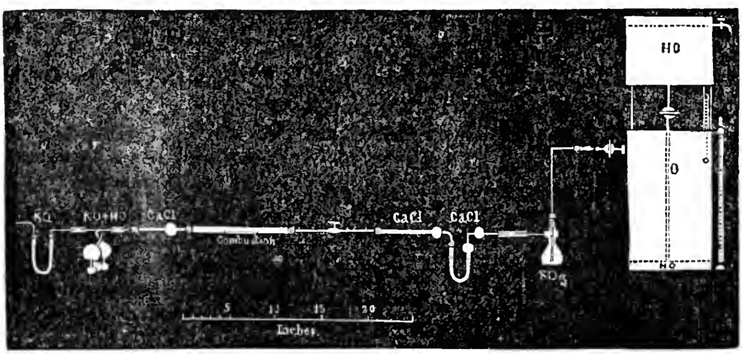
Again, in the ordinary methods, with whatever re-agent, the heat necessary to be applied, and the apparatus for its application, prevent in a great degree, if not entirely, the experimenter from observing what is going on in the tube; so that he is left without any optical grounds, or indeed any grounds at all, beyond the cessation of bubbles in the potash bulbs and an inference from the lapse of time, for judging whether the operation is properly complete or not.

Finally, in any of these methods, the ashes of the matter being lost among the fragments of the re-agents, there is rendered necessary, for the determination of this item, a partitioning of the original sample and a second special operation under all the scope for differences—slight, perhaps, but yet differences—which such partitioning always implies.

It was under these impressions, and with the view of remedying to some extent the defects which have been noticed, that we came to arrange and use the apparatus of which this note is intended to give the description. We have found in its employment that both from the comparatively low temperature necessary, and from the mechanical mode of applying and, when requisite, urging the re-agent, the rate of the whole process becomes under the strictest and most delicate control; that its progress is all the time distinctly seen, and can be judged of; and that the elements usually sought for in organic analysis, (and especially in coals, for the purpose of ascertaining their probable heating power,) are obtained from one and the same weighed portion.

Other advantages which we find it possessing—such as its convenience, being always ready after having been once arranged; its permanence, being not at all liable to get out of order with ordinary precaution; its economy, both as to the time of the experimenter and the money for combustion tubes which, in the former modes, answer but for one experiment and are then thrown away, while in this, the tube, except from some extraneous accident, never breaks and answers for the hundredth experiment as well as for the first; and, finally, the quiet and composure of the whole process, undisturbed by any explosion or decrepitation—need not be dwelt on here. They, of course, will recommend themselves to the practical analyst and are to be duly appreciated; but are not, in our opinion, to be spoken of in the same category with the main feature of accuracy and reliability of result.

The accompanying cut exhibits in section as much of the arrangement as appears necessary to its being clearly understood in connexion with the description following. The letters there are the chemical symbols to denote the occurrence and position of the several re-agents employed.



On the right hand is seen a reservoir of oxygen, somewhat modified from the ordinary Pepys' gasometer. In this, the water reservoir above is furnished with an outlet and cock, (which during use are left open, in

order to maintain a constant level,) and is fed from another vessel of water communicating with it in any convenient manner. We use a syphon. The water reservoir is supported, as usual, by three stems; only one of them, as shown, is opened and widened to hold a thermometer with a small range and open scale, whose bulb plunges into the oxygen reservoir below, and serves to indicate the temperature of the gas. The water is allowed to pass into the lower reservoir of gas by a pipe and stop-cock, as usual; and the orifice of said pipe is also made to receive adjutages of varying bore, so as to regulate with considerable exactitude the rate of supply. Connected with the gas reservoir is a glass tube, which usually indicates the level the water may have attained and consequently the quantity of oxygen on hand; but, in this instance, it is intended to answer a more precise quantitative determination. On the tube are inscribed two scales; one, deduced from the known capacity of the gasometer and calibre of the tube, to show at once the number of cubic inches occupied by the water between any two stand-points on the scale and, of course, when corrected for pressure and temperature, the corresponding volume of oxygen introduced or expelled; and the other, to show at any epoch the fraction of inches of mercury corresponding to the actual pressure of the water, counted downwards from the constant level in the upper reservoir (the design of which constancy is now apparent) to its stand in the tube; which fraction is convenient to be added at once to the observed barometric pressure, in order to give the total pressure under which the oxygen is delivered. With this total pressure and the observed temperature, the normal volume of oxygen used from epoch to epoch can be readily ascertained; the purpose of which ascertainment is, as will be seen presently, to have a check upon the numerical results otherwise obtained. This method of registering the quantity of oxygen used is not, perhaps, the best that could be devised, and leaves something to be desired on the score of minute measurement. But it was the most convenient application to the apparatus that we possessed; and as it can be read, with a vernier, to about $\frac{1}{10}$th of a cubic inch, (or $\frac{3}{100}$ths of a grain in weight nearly,) it is probably commensurate with the accuracy usually thought sufficient in checking a result furnished by other means.

With the stop-cock outlet in the upper part of the oxygen reservoir, as seen on the left of the gasometer, is connected by a pierced cork, one end of a right-angled tube that plunges its other end into a flask of strong sulphuric acid, through which the oxygen, as delivered, passes and parts with its moisture. The remainder of the moisture is supposed to be absorbed by the chloride of calcium contained in the next two tubes, as shown; the first of which, a double bulbed U tube, is connected by a caoutchouc wrapper with the branch proceeding from the upper tubulure of the sulphuric acid flask, and the small end of the second is bent at right angles and is corked into the open end of the first. There is no particular virtue in these various bends and tubulures; they were used because the pieces happened to be on hand, and possessed, as we judged, the quality of containing a sufficient extent of chloride of calcium in a short linear space.

If our judgment as to this sufficiency is correct, the oxygen passes

quite dry into the next small tube, furnished with a stop-cock, and connecting the last calc. chloride tube with the combustion tube itself.

This tube is needlessly long for the purposes it has to answer, which are in fact met by the stop-cock; but it happened to be on hand, and we did not desire to cut it. The purposes intended are threefold: 1st, by shutting off the cock while the gasometer is open and oxygen is being delivered, to secure a sufficient residence of the oxygen in the calc. chloride tubes for this gas to become dry—in fact, to secure a store of dry oxygen; 2d, by a similar shutting off, to convert the combustion-tube into a tube closed at one end, and thus allow of any incidental moisture being drawn off with an exhausting syringe in the usual way; and, 3d, by shutting off more or less, to regulate the flow of dry oxygen, or, if necessary, to cut off the supply altogether. When the experimenter has no assistant, the use of this stop-cock for regulation is more handy than of the one on the gasometer; for the second purpose, we have never used it ourselves, preferring to dry the combustion-tube and its contents by a sustained current of oxygen under pressure, from which there is no danger of vitiation to the result by introducing carbonic acid, as is always the case when a current of atmospheric air is employed in the same way; the first purpose is almost always advantageous, and in some cases indispensable.

We have now come to the combustion tube, which is a piece of hard German white glass, open at both ends for receiving corks. This is lined for about one-third of its length in the middle with a helix of clean and bright copper wire; the purpose of which is to reduce any of the oxides of nitrogen that might be generated from the matter in combustion, and thus to secure the transmission of this element in a free state through the remaining channels of the apparatus. It will, of course, be generally proper to clean and renew the surface of this helix by any convenient method, after each experiment. Resting on this helix is a platinum scroll of known weight, holding the matter for analysis, and retaining its ashes for being weighed after the combustion is completed. This combustion, we have always so far effected with hand-lamps of alcohol, having Argand burners; the heat given by which, is quite high enough to ensure, in a few minutes, the oxidation, in this atmosphere of oxygen, of all the carbon contained in a half grain, or even a grain of coal. To assist in the rapidity of oxidation, we found it advantageous to spread the mass of pulverized matter as thinly as possible over the surface of the platinum scroll. Instead, however, of these Argand burners, whose small extent render the scintillating and perfectly oxidizing temperature too local, we propose to employ, hereafter, a lamp with oblong hollow wicks, extending over nearly the entire length of the combustion tube, and separated by metallic diaphragms of sufficient height, to prevent the spontaneous communication of flame from one to the other, so that each wick may be lighted successively, as desired. This lighting should be commenced and the heat applied first at the end of the combustion-tube nearest the gasometer, on account of the great density of the carbonic acid produced; to assist in the discharge of which, we have found it proper to give the whole apparatus from the gasometer onward an inclination downwards of about a half inch per foot.

The gaseous products of combustion pass off first into a calc. chloride tube, whose smaller end is corked into the combustion tube, and which retains the vapor of water from the hydrogen given up by the matter; and next, into an ordinary quintuple bulb arrangement, containing a solution of potassa, which takes up the greater part of the carbonic acid that has been formed. The remaining carbonic acid (such, for instance, as may have been formed and delivered from the combustion tube faster, owing to some occasional irregularity, than could be absorbed by the potash solution, and which we have found in appreciable quantity,) is caught by, and increases the weight of the fragments of solid pötassa contained in the U tube on the extreme left of the apparatus.

Finally, to complete the design which has been indicated in the calibration and graduation of the oxygen reservoir, must be imagined a bent glass tube connected with the last mentioned U tube at one end, and leading into a mercury trough under a suitable receiver, where all the remaining gases from the combustion tube are at last gathered. As these gases can be only oxygen and nitrogen, they may be transferred from the receiver into a Volta or other eudiometer; where the volume of oxygen is determined either by detonating with hydrogen, by platinum sponge, or any other eudiometric mode that may be preferred. The volume of oxygen being thus known, the volume and, consequently, the weight of the nitrogen that was in the receiver can be readily deduced.

In the mean time, the combustion being terminated, the platinum scroll, which now contains but the ashes of the matter, is withdrawn from the tube and weighed; the difference between the weight now found and the original weight of platinum alone, is that of the ashes.

We have now the weight of earthy matter and of the four principal volatile matters which constitute the coal, directly determined. And, by the use of the graduated scale on the gasometer, we have also a check upon the general accuracy of the whole operation; for, if the epochs have been carefully observed, the quantities of oxygen that by calculation must have been taken up in forming carbonic acid and water, should equal the whole quantity of oxygen directly observed to have been delivered from the gasometer during the process.

In illustration of what has been said as to the uniformity of results attainable by this method, we subjoin an extract from the note book of weights obtained successively from two portions of the same sample of coal in two different experiments; the calc. chloride tube having been changed in the interval, so as to afford a quite different initial weight, and thus having prevented any possibility of pre-occupation in making the weighings.

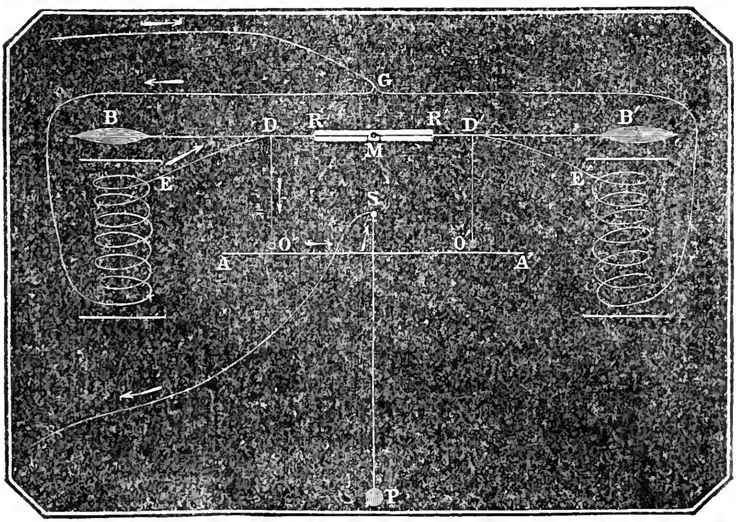
Quantity of coal taken in each experiment, 0·5 grain.

	1st Exp.	2d Exp.
HO . .	0·25 gr.	0·24 gr.
CO^2 in bulbs, .	1·59	1·61
CO^2 in U tube,	0·06	0·04
Ash, . .	0·02	0·02

Translated for the Journal of the Franklin Institute.

Veritè's Electric Clock.

We owe to the friendship of M. l'Abbé Duporq, Professor of Physics in the large Seminary of Beauvais, the description of the electric clock of M. Veritè. In making the clock, the electric communications are hidden so as to allow all possible grace. The valuable part of this delightful invention is, that it requires only a very feeble electric current; the action of M. Veritè's battery retains sufficient intensity for more than six months; its price is insignificant; a zinc or copper plate, and a little sal ammoniac or sulphate of copper are the essentials. The whole is easily included in the case of an ordinary clock, and the most delicate sense of smell could not suspect its presence. The pendulum S P, with its horizontal brass cross-piece A A′, is suspended by an elastic steel spring from a fixed point S, in communication with one of the poles of the battery. Above, a balance beam B B′, fixed on a movable axis M, is composed of an insulating part R R′, and carries at its extremities plates of soft iron, which are alternately attracted by the electro-magnets E and E′. The current comes to the electro-magnets by a wire which divides at G, and is wrapped from right to left around the electro-magnets. Finally, the current, after traversing the wire of the electro-magnet E for instance, passes to the arm B D of the beam B B′ re-descends by a very fine and flexible silver wire D O, and completes the circuit by the ball O, in its contact with the cross-piece A A′. The balls O and O′ give the impulse to this ingenious escapement of M. Veritè, applied by him in 1844.



The movement is easily understood. If a first impulse to the left is given to the pendulum, the cross-piece A A′ touches the ball O, and the current is established; the electro-magnet E pulls down the arm B D,

and with it the point of attachment D, of the wire which carries the ball. The ball O, its point of suspension being lowered, will not then abandon the cross-piece A A′, except at a point lower than that at which it met it, and consequently will give an impulse to the pendulum. But soon its contact with the cross-piece ceasing, the current ceases to pass around the electro-magnet E; then the pendulum rises on the right-hand side, the cross-piece meets the ball O′, and the same effects are reproduced on this side. The movement has commenced, and will continue so long as the current has sufficient force to cause the movement of the balance beam.

If a fork like that which works the needle of the receiver in electric telegraphs be adapted to the balance beam B B′, we have every thing necessary for marking seconds. M. Veritè gets, moreover, from the same motive power, the force necessary for his striking-works. So that we have here a clock, marking and striking the hours without weights or springs, solely by the electric force.

For the Journal of the Franklin Institute.

The San Francisco.

HULL.—Length on deck,		286 feet.
Breadth of beam,		41 "
Depth of hold,		16 "
" " to spar deck,		24 "
Length of engine and boiler space,	104 ft. by 15 ft. in width, including passages.	
Draft of water at pressure and revolutions, given below,		11 feet 6 inches.
Area of immersed midship section at this draft,		443 square feet.
Capacity of coal bunkers, in tons of coal,	500	
Draft of water at load line,		13 feet 6 inches
Floor timbers at throats, moulded,		16 "
do. do. sided,		16 "
Distance of frames apart at centres,		3 "
Masts and rig,		Foretopsail schooner.
ENGINES.—Two inclined oscillating.		
Diameter of cylinders,		65 inches.
Length of stroke,		8 feet.
Maximum revolutions per minute,	22	
BOILERS.—Two, round shell and drop flued.		
Length of boilers,		34 "
Breadth of boilers,		13 " 6 inches.
Height of boilers, exclusive of steam chimney,		13 " 6 "
Number of furnaces,	4	
Length of grate bars,		7 "
Number of flues,	24	
Internal diameter of flues, 1st range 16 inches, 2d range $21\frac{1}{2}$ inches, 3d range $17\frac{1}{2}$ to 15 inches.		
Diameter of smoke pipes, (two,)		4 feet 4 inches.
Height of smoke pipes,		30 "
Maximum pressure of steam in pounds,	20	
Description of coal.		Bituminous.
Area of flue and fire surface in boilers,		6000 feet.
WATER WHEELS.—Feathering.		
Diameter,		28 "
Length of blades,		8 "
Depth of blades,		4 "
Number of blades,	14	

A description of this steamer, with the above statement of her principal dimensions, was given in this Journal about six months ago. But, since the terrible disaster which has recently befallen her, we consider the present a fitting occasion to republish that description, add to it a few particulars, and make some remarks on the causes of her loss.

The San Francisco was a steamer of about 2300 tons burthen, (custom house measurement,) built for the Pacific mail service. It is well known that the weather on the Pacific coast is less severe than that which must be encountered by vessels navigating the Atlantic. And as the exigencies of the service demand accommodation for a great number of passengers, it is usual to obtain large room on small vessels by two expedients, both of which would be objectionable for Atlantic steamers. One is to extend the guards fore and aft, narrowing from the full width at the wheel-houses, to nothing at bow and stern, giving additional deck room, but unsuited for severe weather at sea, for reasons which it is unnecessary to enlarge upon. The other is to "build on" deck-houses, with very light bulwarks, &c., which, on account of presenting large surface to the wind, and the danger to passengers of being swept overboard by heavy seas, is open to the same objection as the first expedient. With both, however, was the San Francisco provided; and they would doubtless have added much to her comfort and capacity had she reached Panama. If the propriety be questioned of sending such a vessel round Cape Horn at this season of the year, deeply laden, with a regiment of soldiers, and their stores, it should be borne in mind as an extenuating circumstance, that other vessels, apparently less able to cope with rough weather, certainly older, and in some cases possessing more objectionable features, have made the same passage in safety, and are now running on the other side.

Care seems to have been taken by the builders of the hull to render it as strong as possible, for although not heavily timbered, she was strengthened by double diagonal iron braces, secured above to a plate running the whole length of the ship under the water ways; and furthermore, her machinery being narrow, allowed of two crossed-planked, iron-braced bulkheads, fifteen feet apart, and extending the whole length of the ship from the timbers up to the spar deck, which must have added materially to her strength. Indeed, when we consider the tremendous seas she encountered, and in which she remained afloat for fifteen days, it must be conceded that the hull (guards excepted) was as strong and seaworthy as that of any steamer afloat.

Her machinery possessed some peculiar features. The boilers, two in number, were placed one forward and one abaft the engines, instead of abreast of each other, as is usual—thus admitting of the bulkheads before described. Coal was stowed alongside the boilers and engines, which occupied 104 feet length in the ship. Each boiler had a separate funnel. Her fire-rooms were air-tight, the air for combustion being supplied by fan-blowers, driven by separate engines. Two Worthington steam-pumps were fixed to the side bulkhead under the lower deck, and were connected to a small boiler on the spar deck, so that they might be worked when the large boilers were not fired up.

Her two driving engines were oscillating, inclined 45° from the verti-

cal line, and attaching to the same crank pin. The cylinders were provided each with two piston-rods, either one the same diameter as made by the usual proportion for fixed cylinders; and for additional security, the journal block of the crank-pin (through which the two piston-rods passed like cap-bolts) was confined within guides bolted to the cylinder cover. The use of two piston-rods in oscillating engines is a novelty, and so far as could be judged from examination, without trial, seems to be an improvement. The valves were poppets with vertical stems, arranged in a simple and compact manner, steam and exhaust channels diverging from the trunions to each chest. In starting or stopping, the engineer stood on a platform moving with the cylinder. The frames of the engine were principally of boiler plate. Directly beneath the shaft, and in the angle formed by the frames, was the condenser, a large cast-iron cylinder, made to receive the tubes of a surface condenser—which, however, were removed for some cause before the departure of the ship, leaving the case to be used as a spray condenser.

The air-pump was horizontal, double-acting, driven by direct attachment to an independent steam cylinder, placed fore and aft, between the frames. Engineers are aware that one of the principal objections urged against the oscillating engine, consists in the inconvenience of working the air-pump. In double engines this has been accomplished by cranking the centre shaft, adding to its expense and weight, which arrangement is otherwise very objectionable from the fact that the centre-shaft is the part most likely to break, and its breakage might disable the condensing apparatus. An eccentric on the centre shaft is worse, on account of its enormous friction, and the same liability to give out. Where no centre shaft exists, as in single engines, the experiment has been tried of working the air-pump from an overhead beam, actuated by a link taking hold of the crank-pin journal. This was done on the Savannah steamers Augusta and Knoxville, and though superior to the former-named plans in economy and safety, is cumbrous and uncouth. Another plan which appears superior to all the others, has been tried in propeller engines, but we believe not in side-wheel engines, viz: driving by gearing. The result of the experiment on the San Francisco gives cause for regret that this latter plan had not been adopted. Those concerned in deciding on the main features of her machinery, however, no doubt took all these plans into consideration, and finally resolved upon the one we have described. The arguments which might be adduced in favor of their decision were, that besides its convenience, the pumps could be made smaller, and driven faster; that their speed could be regulated to maintain the same vacuum, even in a heavy gale of wind, when the main engines could move but slowly, although steam was following the whole stroke; that before starting, a vacuum might be obtained so that the engines could be hooked on without delay. These reasons may have decided the adoption of the scheme; the great argument against it has been developed in the event, and will be noticed hereafter.

The wheels were of the kind known as Feathering, in which the buckets enter the water in a position nearly vertical, being revolved by links attached to an eccentric ring round the shaft. The links were

placed inboard, the shafts supported on the guards, as usual in radial wheels. This feathering wheel was introduced some years ago in England, and recently the West India Mail Company put it on four of their new ships; but we understand it has since been replaced by the ordinary form. Except simplicity, we believe that no special advantage was claimed for the San Francisco's wheel over those made in England. These wheels are enormously expensive, very heavy, and from their liability to derangement, are better suited for river or bay navigation than for sea service. They might, however, have given satisfaction on the Pacific routes. Such were the main features of the San Francisco. So far as related to the proportions and mechanical execution of the work, the high reputation of its builders was fully borne out, if we are to believe those engineers who examined it before the ship left.

She was advertised to sail November 15th, but from various causes was not completed in time; indeed, her engines were not tried at the dock till the beginning of December, and after three trials down the bay, she was ready to sail on the 22d. On the first of these trials, the vacuum obtained was very poor, on the second the independent engine gave out, and the condenser tubes were removed subsequently. It appears, therefore, that the principal trouble arose from the condensing apparatus, as well on her trials as on her trip subsequently. We are under the impression that the ship never went to sea until on her regular trip. Her owners had contracted with government to convey to California eight companies of the third regiment of artillery, and in addition there were some army and navy officers, with their families, and a few civilians on board, as passengers. The stores required for this vast number of persons, and the coal for her voyage to Rio, sunk the ship considerably below her proper draft. Her cylinders were of small size, being only about $\frac{3}{8}$ the capacity of those of Collins' steamers, which are but 25 per cent. greater tonnage. Consequently, a high rate of speed could not be expected, even at her load-line, much less at the heavy draft at which she left port.

It appears from a statement published in the N. Y. Tribune, said to have originated with the Chief Engineer, that the ship had on board 3500 barrels of stores, rations, &c., which would weigh about 600 tons; and 750 tons of coal, or 250 more than her full complement. The latter is probably understated, as a voyage to Rio would require at least 35 days coal, which would give but 22 tons a day. Allowing this statement to be correct, however, and remembering that the Pacific mail steamers carry but little heavy freight, it is probable that she was overloaded to the extent of at least 600 tons, or was drawing three feet more than her ordinary load draft.

At 9 A. M., on the 22d, she left quarantine, and by her log attained a speed not exceeding $7\frac{3}{4}$ to 8 knots, during calm weather, the first thirty hours out. At this time commenced a heavy gale from N. W., shortly after which she "broached to" twice, becoming unmanageable in the trough of the sea, on the second occurrence of which she could not again be brought on her course. This was at 11 P. M.; two hours afterward, or 34 hours out of New York, and four hours after the commencement of heavy weather, the independent engine gave out by the breaking of

the air-pump piston-rod and the driving engines were stopped, there being no means of obtaining a vacuum. The vessel having previously lost her masts in the effort to bring her on her course, was by this disaster converted into an unmanageable hulk, exposed to the fury of the winds and waves; and it was only after fourteen days of intense suffering and privation, attended by great loss of life, that the vessel was finally abandoned, and the survivors taken off. It appears that an effort was made by the engineers to exhaust into the open air, by using for the purpose the smoke-stack of the small boiler, and so to continue working while endeavoring to repair the broken rod, but that, in consequence of the loss of the large smoke pipes, and the fact that the blower-belts were so low as to be covered by water, steam could not be maintained in the boilers to work the driving engines without condensing; it was also found that the small boiler had to be used for the steam pumps, and so the stack could not be used for the purpose. About three days after the break, on the 27th, the rod having, after great labor, been repaired, the engines were again started, but only to work about ten minutes, when, on the same part again giving way, the wheels of the ill-fated vessel made their last revolution.

On considering all the circumstances attending the break down, which have been gathered from the published accounts, its cause will become apparent. It is not a new expedient to work an air-pump independently of the main engine. This has before been done, *but in still water*, and not at sea; and it would seem that so long as the surface of the ocean remained tolerably smooth, no accident occurred on the San Francisco. But immediately after the vessel gets into the trough of the sea, it is not difficult to imagine that on account of the varying depth of water over the injection holes, the quantity of water entering the condenser would vary at different times; that the pump would sometimes be flooded and "brought up," and alternately accelerate its velocity until again flooded, &c. There being no adequate means of regulating speed, (for a common governor would have no effect in such a case,) this sort of action must take place in a greater or less degree; and there is reason to suppose that as the pump was double-acting, had a solid piston, and moved generally 40 to 50 strokes per minute, that however well designed or constructed may have been the machinery which gave motion to the pump, some part of it would inevitably give way under such trying strain. If this reasoning is borne out by the facts, it is an insuperable argument against a repetition of the experiment.

The only benefit which can be drawn from disasters like that of the San Francisco, is to take from them, after investigation of the causes, a warning for the future;—such is our present purpose.

From what has been said, it will be evident that the loss of the San Francisco may be traced principally to the failure of an experiment in the manner of working the air-pumps. This, in connexion with her heavy draft of water, the unsuitableness of her guards and top hamper to heavy weather, and the fact that she was sent on a long sea voyage without a proper trial trip at sea, seem to comprise all the causes of her disaster.

In the reckless disregard of human life which seems at times to charac-

terize our whole system of traveling conveyances in this country, we are all apt to overlook the deep responsibility which attaches to those who are concerned in their construction. While it happens that both in railroad and river (steamboat) navigation some hope is held out in case of disaster to passengers, who are on or near land, and generally within the reach of aid from others,—at sea, on the contrary, the violence of the weather, the danger of fire, the distance from all human aid other than that which may be furnished from within the vessel herself, combine to enhance the importance of the results which may flow from accident, and seem to call loudly on those who are concerned in the construction either of the hull or machinery for additional care, and to demand that all the resources of science and of experience shall be employed to ensure continuous and satisfactory performance of the latter. In view of such responsibility, is it right to risk the lives of passengers on any *experiment*, however plausible? Owners or builders may be confident of success, and impressed with a sense of the important advantages to be gained by some innovation on established usage; but so long as it remains an experiment, not fully tested, no one has a right to introduce it upon marine steamers—where a stoppage for a *few minutes only* may cause the destruction of the ship and lives of those on board. We recommend this train of thought to all who are in any way concerned in building up our steam marine.

For the Journal of the Franklin Institute.

Description of Trapp's Barrel Machine. By Washington Jones, Esq.

This is a machine invented by Mr. Trapp, of Elmira, New York, for making barrels, buckets, &c. It performs all the work necessary to complete a barrel, except setting up the staves, putting in the heads, and driving the hoops. The rough staves are cut from the stick of wood by a cylindrical saw of the proper diameter; the rough ends are then cut off by two circular saws, that are fixed upon the same shaft, at a distance apart somewhat more than the length the staves should be when finished; the staves are then fed to the dressing machine, which consists of a revolving circular plate, fitted with cutters that project slightly beyond its periphery, for dressing the inside or concave of the stave, and a ring that revolves upon another ring, having cutters projecting beyond its inner edge, for dressing the outside of the stave. Each dresser revolves, at a high speed, in a plane at right angles to the grain of the wood.

The staves are carried through the dressing machine by serrated rollers, and are prevented from being carried sideways by the action of the cutters, by grooved rollers, whose projections are forced into the wood by springs; the indentations are afterwards cut out with the shavings taken off by the knives of the outside dresser.

The next operation, giving the staves the proper shape and bevel on the edges, is performed thus: they are placed, one at a time, in a light frame of wood, and forced by the action of a lever upon the bed piece of the frame which has the same curve as the side of the intended barrel. The lever locks itself, and hold the stave firmly. Upon the outside of the frame, in a line perpendicular to the cross curve of the stave, and at a

distance from it equal to the half diameter of the barrel, are two projecting pins, that fit into sockets fixed to a frame that surrounds a revolving wheel, termed a jointer, fitted with cutters, which turn in a horizontal plane: the centres of the sockets are in the same plane as the cutting edges of the cutters. The pins are placed in the sockets, and the opposite side of the frame brought down until the contained stave bears upon the cutters; they remove the rough edges, and give the proper shape and bevel; the frame is turned over and the other edge of the stave finished in the same way before it is removed from the frame: this insures the same width at the ends of the staves, and consequently, the barrel made of them will be the same diameter at the heads. The "setting up" is performed by hand, and two metal hoops are driven on about one inch from each end; the barrel is then placed in two rings of metal that are arranged so as to revolve freely. One of them can be made to approach, or recede from the other, by a screw and handle; the barrel is secured by forcing the movable ring towards the other, until its motion is arrested by the metal hoops, previously driven upon the barrel, over which the two rings fit; upon the sustaining frames of the revolving rings, are three movable tools, fitted with knives of a suitable shape for smoothing the ends of the staves, giving the chamfer and cutting the croze for the reception of the head.

The barrel being made to revolve by a belt passing round it, or by some other suitable means, the tools are brought against the staves, and the superfluous wood cut away. The exact motion of each tool is regulated by a stop; this insured uniformity of length and interior diameter, which is of importance, particularly the latter, as the heads are all of one diameter, and should fit in any barrel. In making whiskey barrels, the outside is sometimes turned off, by means of a tool, that slides upon a bed of the same curve as that desired for the barrel, and fed by a screw; but, that is not absolutely required, as the staves are smooth, and of uniform thickness.

The heads are finished in this manner: after the slabs have been cut by a circular saw and the edges straightened upon the jointer, two or three of sufficient width to form the head are placed edge to edge, between two circular plates, one of which, having a number of sharp steel points projecting from the surface, revolves upon its axis; the other plate does not revolve, but, is moved in the direction of its axis, by a screw that forces the slabs against the points, which penetrate the pieces, and hold them in position: the revolving head is put in motion, and two cutters are brought by the motion of a lever against the wood, which is cut into a circular shape by their action: a further movement of the lever brings a part of the cutter in contact with the wood, giving the proper bevel to fit in the croze made in the staves to receive it. The outside of the head can be turned off, if desired, by a tool arranged for the purpose; but, as this adds to the cost of the barrel, without bettering its quality, it is not usually done. Each machine is capable of turning out from two hundred and fifty to three hundred barrels in a day, depending upon the quality and seasoning of the material. The smallest kegs, as well as the largest hogsheads, can be equally well made by the machine. One, for flour

barrels, has been built by Messrs. Reaney, Neaffie, & Co., of Philadelphia, for a company who have it in operation near the Navy Yard, where it can be seen by those interested in such matters.

For the Journal of the Franklin Institute.

Description of Birkinbine's Patent Supplementary Valve for Cornish Engines. By H. Howson.

I beg to call your attention to the accompanying sketch of a supplementary valve apparatus for cornish engines, for which a patent was granted to Mr. Birkinbine, of this city, in November last. The invention, though simple in itself, is likely to prove of considerable importance in connexion with a class of steam engines, the merits of which have as yet been scarcely appreciated in this country, but which are now beginning to attract the attention of engineers, and will, without doubt, be eventually adopted in preference to all other hydraulic machinery for mining purposes, water works, &c.

The Cornish engine, so called from its universal adoption in the mining districts of Cornwall, England, is single acting, the pressure of the steam acting on one side of the piston only, thereby raising the plunger and any requisite additional weights. The steam thus used in raising the plunger is afterwards admitted to the opposite side of the piston, and thus equalizing the pressure on both sides, the weighted plunger descends and forces the water to the required height, completing one stroke of the engine. The steam contained in the cylinder is on the commencing of another lift of the plunger carried off through the exhaust pipe to the condenser.

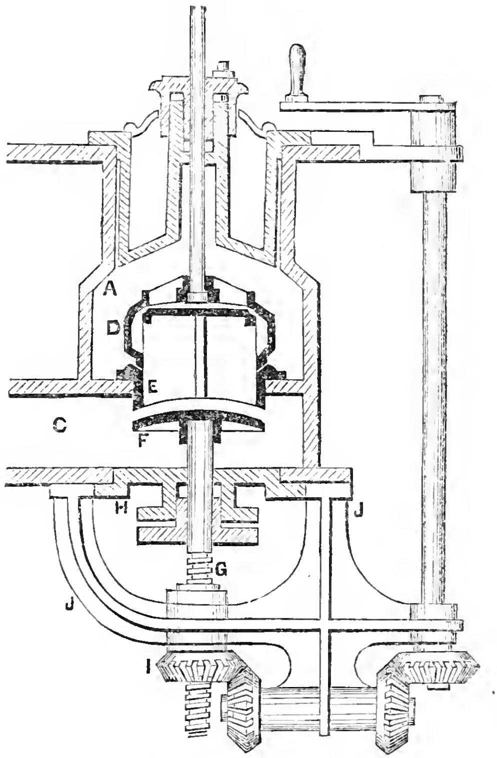
The several evolutions of the engine are effected by four valves; first, the regulator, through which is admitted the steam in the first instance, and whose movements are regulated by hand only; secondly, the steam valve which admits steam to the cylinder; thirdly, the equilibrium valve, by means of which the pressure on both sides of the piston is balanced; and, fourthly, the exhaust valve through which the steam is carried off to the condenser.

These valves are actuated by tappets on a plug rod, which moves simultaneously with the piston, in conjunction with weighted levers, and the ingenious and well known cataract motion, the tappets serving to close, and the weighted levers (whose action is dependent on the cataract) to open the several valves. These are contained each in separate compartments of a chest or nozzle, communicating with each other and with the cylinder.

The required volume of steam is, in the first instance, admitted through the regulator valve into the compartment occupied by the steam valve, on the opening of which, by a weighted lever released by the cataract, the steam is admitted to the cylinder, thereby raising the plunger to the required height. In another compartment, which communicates with the passage through which steam was admitted to the cylinder, is situated the equilibrium valve, on the raising of which, the steam in the cylinder which has performed its duty of raising the plunger, passes into the space

c, and thence through a pipe or passage to the opposite side of the piston, thus allowing the plunger to descend. The space c communicates with the chamber of the exhaust valve, as well as with the equilibrium passage; the exhaust valve is, however, closed as long as the equilibrium valve is open, and is not again brought into action until the engine is prepared to commence a new stroke.

The accompanying sketch represents a sectional view of that portion of the valve nozzle only which contains the equilibrium valve, which will no doubt be sufficient, with the foregoing brief explanation, to render Mr. Birkinbine's patent apparatus familiar to your readers.



It may be here remarked that all the valves are of the double beat description, so called from having two conical or beating surfaces instead of only one, as in the ordinary stalk valve, and are in principle similar to those used in stationary and marine engines, and denominated balance valves. D is the equilibrium valve contained in the compartment A, which communicates with the passage from the steam valve to the cylinder. The seat of the valve D is secured to the bottom of the compartment, and has a circular flanch E projecting through the opening. This projecting flanch forms the seat for the supplementary valve F, which is attached to the top of the screwed spindle G; the latter passes through a stuffing box in the cover H, and screws into the hub of the bevel wheel I, which runs

loosely in the bracket J; this wheel is caused to revolve, and thus the supplementary valve raised or lowered by the handle K, and shaft L, and the additional bevel wheels.

The object of the invention is to arrest, more or less, as circumstances require, the passage of the steam through the equilibrium valve from one side of the piston to the other, and, consequently, of regulating the descent of the plunger.

The utility of the arrangement will be at once apparent; it obviates the necessity of adopting the old and tedious process of adding and removing heavy weights, while, in case of any breakage, or other accident occurring to the pumps in a mine, the damage likely to occur from sudden shocks is prevented by the facility of adjusting the valve to regulate the descent of the plungers.

It is in Cornish engines, when used for water works, however, where the utility of this invention may be brought into practice most advantageously, especially in those works where a stand pipe is used to obtain the necessary head of water; in this case the fluctuation in the level of water is necessarily sudden, and of considerable extent, causing a similar variation of load on the engines, and rendering the machinery most unsafe and uncertain in its action.

Should the head of water in the stand pipe be low, the plunger would have a tendency to descend with a dangerous rapidity, which is checked in a moment by turning the handle K, so as to raise the supplementary valve F, thereby arresting the steam on its passage from one side of the piston to the other, the plunger consequently descending with a safe and gradual motion.

Should the head of water, on the contrary, be high, the valve F is instantly withdrawn from the seat, and a free passage given to the steam, the head of water being in itself sufficient to ensure an easy descent of the plunger.

Although the apparatus is shown in the sketch as regulated by hand, it is proposed in some instances to allow the variations in the head of the water to be the means of adjustment, an application which might be made by a simple arrangement of machinery.

It is, I am informed, Mr. Birkinbine's intention to apply his supplementary valve to the large engines he is now erecting for the West Philadelphia Water Works.

Stockton House, *Philada.*, *Jan.* 10*th*, 1854.

For the Journal of the Franklin Institute.

The French Line-of-Battle Screw Steamship Charlemagne. By B. F. Isherwood, Chief Eng., U. S. N.

The *Charlemagne* is an old French ship of war, altered to a screw propeller steamship, in 1851, in accordance with the plans of Mr. Barnes. After this transformation, she was tried by a government Commission, which experimented with her in the Mediterranean, between Toulon and Spezzia, and from whose report, principally, the following elementary data was obtained; where it was deficient, I have completed it from other

sources. I have used the report of the Commission no farther than to select from it such observed data as was requisite for basing my own calculations and deductions.

Engines.—The engines were four in number, condensing, and direct acting, making one double stroke of piston for each revolution of the screw. The steam was cut off in the cylinders by lap on the slide valve at $\frac{7}{10}$ths of the stroke of piston from the commencement, and by cams and independent cut-off valve at $\frac{6}{10}$ths, $\frac{5}{10}$ths, $\frac{4}{10}$ths, and $\frac{3}{10}$ths the stroke of piston from the commencement.

Diameter of cylinders, . . .	4 feet $3\frac{1}{4}$ inches.
Stroke of pistons, . .	3 " $3\frac{3}{8}$ "
Space displacement of all pistons per stroke,	188·014 cubic feet.

Boilers.—The boilers are four in number, with horizontal tubes returned above the furnaces. They are arranged in pairs, facing each other, with their backs against the sides of the ship, having one fire room in common, extending between the two pairs of boilers in the fore and aft direction of the vessel.

Screw.—The screw is placed in the stern of the vessel, and is fitted with the usual hoisting-out apparatus, so that it can be lifted up through a trunk in the stern, when the vessel is under sail alone. The screw makes one revolution to each double stroke of engines' pistons, and is of uniform length in the direction of the axis from hub to periphery.

Diameter of the screw, . . .		16 feet 4·8 inches.
Pitch, . . .		22 " 11·5 "
Number of blades, . .	2.	
Fraction of the pitch used, . .	2-7.	
Length of the screw in the direction of the axis, .		3·28 feet.
Helicoidal area of the screw, . .		79·523 square feet.
Projected area of the screw on a plane at right angles to axis,		58·952 "
Diameter of the hub, . .		2·5 feet.

Weights of the Machinery.

Weight of engines and boilers, &c., with tools, but not with water in boilers, . .	217 tons.
Weight of water in boilers, . .	48 "
Total weight of machinery, .	265 tons.

Hull.—

Length on load water line, . .		197·08 feet.
Breadth extreme, . .		53·28 "
Draft of water at the commencement of the experiments, taken below the first false keel and the stem and stern posts,	Forward,	23 ft. 0 ·7 inches.
	Mean,	24 " 2 ·7 "
	Aft,	25 " 4 ·7 "
Area of immersed amidship section at above draft, .		986·31 square feet.
Displacement in tons of 2240 pounds at above draft,		4680

At the above draft of water, the vessel had on board her complete armament, (90 guns,) and the following stores, viz:

Sixty days' provisions for 864 men, estimated at	$85\frac{1}{2}$ tons.
Thirty days' water for 864 men, estimated at .	78 "
Newcastle coal, ...	260 "

During the trials, the topmasts were on end and all the sails bent.

Experimental Results.—The data contained in the following table is a summary of the observations made by order of the Commission, noting every

half hour the number of revolutions made by the screw, as registered by the counter; the pressure of the steam as indicated by two gauges placed on the steam pipes; the amount of opening of the throttle valves, the point at which the steam was cut off in the cylinders, the quantity of coal consumed, the speed by log, and, finally, the state of the wind and sea.

The mean effective pressure throughout the stroke of pistons was obtained by an indicator, but the Commission, in presenting their results, subtracted from that *gross* mean effective pressure $1\frac{1}{2}$ pound per square inch of pistons for the friction of the machinery, and gave the remainder as the mean effective pressure in their report. This $1\frac{1}{2}$ pound per square inch I have restored, and have made the friction deduction in another manner, which I consider to be more exact.

Table of Results of the Trials of the Charlemagne.

Total distance run in metres, . .	49993	233301	122205	112392	185675	49993
Total distance run in geograph. miles of 6082⅔ feet, ...	26·966	125·843	65·918	60·624	100·153	26·966
Total time in hours and minutes of running the total distance, . . .	3 4	14 30	8 0	8 40	10 31	3 4
Mean speed per hour in geo. miles or knots, by the distances, . . .	8·793	8·679	8·240	6·995	9·523	8·793
Mean speed per hr. in knots by the log.	8·360	8·500	8·260	6·980	9·410	8·800
Total number of revolutions of the screw for the run, by the counter, . .	9186	42524	22608	20490	32980	9330
Mean number of the revolutions of the screw per minute, ...	49·77	46·88	47·10	36·43	52·26	50·70
Slip of screw in per cents. of its speed, calculated for speed of vessel by the distances, ...	22·22	21·59	22·75	21·60	19·54	23·42
Steam pressure in boilers in pounds per square inch above atmosphere,	7·06	3·19	2·94	3·68	5·14	5·14
Proportion of throttle open. . .	·5	Wide.	Wide for 7 hours.	·3	Wide.	Wide.
Steam cut off at from commencement of stroke of pistons, . . .	·7	·7	·7	·5 for 1 hr. 30 min. ·7 for 7 hs. 30 min.	·7	·7
Mean effective press. throughout stroke in pounds per sq. inch of pistons, .	11·35	11·06	10·18	8·41	12·09	12·09
Horses power developed by the engines for the above mean effective pressure throughout stroke, . . .	926·87	850·75	786·73	502·71	1036·70	1005 76
Resistance of the hull, or thrust of the screw, in pounds by dynamometer,	18531	17949	16483	13341	20000	20000
Horses power expended in propelling the simple hull by dynamometer, .	500·57	469·85	417·24	286·68	585·10	540·25
Immersed amidship section of the hull in square feet, ...	979·96	971·33	963·90	958·54	953·19	949·97
Number of boilers under steam, .	4		4	2 for 2 hs. 40 mins. 3 for 4 hours.	4	
Pounds of coal consumed per hour, .	5247		5181	3064 2659	5733	
Coal consumed per 24 hours in tons of 2240 pounds, ...	56·218		55·511	32 829 28·490	61·425	
State of the sea, ...	Calm.		Calm.	Calm.	Dead calm.	Smooth.
State of the wind, . . .	Light br. aft.		Light aft breeze.	Calm.	Calm.	Light brz ahead.

Friction of the Screw Surface on the Water.—The foregoing data allows a calculation to be made of the power absorbed by the friction of the screw surface on the water. For this purpose the data will be taken from the 5th, or next to the last column of the above Table of Results, because as in that column will be found the most profound calm of wind and sea, no corrections will be required for a disturbed state of those elements.

The power required to overcome the friction of the engines, as ascertained by actual experiment on an engine of about the same size and speed of piston as one of the *Charlemagne's*, will be taken at 1·25 pound per square inch of pistons, and the cœfficient for the friction of the load,

according to Morin's experiments, at 0·075, which, as the mean effective pressure is 12·09 pounds per square inch, will be (12·09×0·075=) 0.91 pound per square inch, making a total of (1·25+0·91=) 2·16 per square inch for the friction resistances of the engines and load, which is 17·87 per centum of the total power developed by the engines, or 185·26 horse power. The power employed in the propulsion of the simple hull was 585·10 horses by dynamometer, and as pressure and resistance are equal and in opposite directions, the power lost in slip will bear to that utilized in the propulsion of the vessel the same ratio that the speed of the slip (or in other words, the velocity with which the water is driven back by the recession of the screw) bears to the speed of the vessel. Now, the slip of the screw was 19·54 per centum of its speed, leaving the speed of the vessel to be expressed by (100·00—19·54=) 80·46; therefore, as 80·46 : 19·54 :: 585·10 : 142·09, the horses power lost by the slip of the screw. After deducting the power 585·10 horses employed in propelling the simple hull, the power 142·09, horses lost in slip, and the power 185·26 horses expended on the friction resistances of the engines and load—total, 912·45 horses, from the total power 1036·70 horses developed by the engines, there remains (1036·70—912·45=) 124·25 horses power, which is the amount absorbed by the friction of the screw surface on the water.

Collecting the above, we have the following disposition of the power, viz:—

	Horses Power.		Per Centum.
Propelling the simple hull of the vessel, . .	585·10	or	56·44
Expended in the slip of the screw, ...	142·09	"	13·70
Expended in the friction of the screw, . . .	124·25	"	11·99
Expended in the friction of the engines and load, .	185·26	"	17·87
Totals, ...	1036·70	or	100·00

Explanatory of the Losses of Power by Slip of the Screw.—In observing the above disposition of the power, a clear distinction must be kept in view between the power expended in the slip of the screw, 142·09 horses, or 17·87 per centum of the total power developed by the engines, which is the amount of power employed in merely giving a backward motion to the water passed by the screw, and the power actually *caused* to be lost by the slip of the screw. This latter is equal to the per centum of the screw's slip, and in the present case would amount to 19·54 per centum of the total power 1036·70 horses developed by the engines, or to 202·57 horses power: because by the reason of the screw having a slip of 19·54 per centum, and as the mean effective steam pressure on the engines' pistons continues the same, the speed of the engines has to be 19·54 per centum greater to give the vessel an equal speed in equal times than if there were no slip. Of course, this *causes* a loss of 19·54 per centum of the power required to work the engines—of the power expended in the friction of the screw surface on the water, and in the power required to propel the simple hull of the vessel. But the sum of the powers *non-utilized*, viz: those expended in slip, in friction of the screw, and engines, and load, total 451·60 horses, will remain the same, however divided: and the power 585·10 horses *utilized* in the propulsion of the vessel, will consequently remain the same also.

The foregoing disposition of the power, in connexion with the following table of calculations on the screw of the *Charlemagne*, enables us to determine the friction in the pounds avoirdupois of the square foot of the screw surface moving in its helical path with the velocity of 10 feet per second. For this purpose, the screw surface in the following table has been divided into a number of parallel strips, or *elements*, 0·25 foot wide: the length of the central helix of each of these elements has been taken as the length of the element, and the "expression for the friction of each element" has been computed separately as the friction is in the ratio of the squares of the velocities. This calculation for the expression of the friction has been made for convertibility into horse power, supposing the friction of each square foot moving with a velocity of ten feet per second to be an *unit* of weight. After the total friction of the screw for a speed of ten feet per second has been ascertained in horses power for a *unit* of weight, it is easily resolvable into the *true* friction in pounds, by dividing it into the "friction of the screw surface on the water" in horses power, as ascertained by the preceding "deposition of the power." For the rest, the table of calculations carries its own explanation.

This determination being made, gives for the value of the friction of one square foot of screw surface moving through water, in its helical path, with a velocity of ten feet per second, 0·7796 pound avoirdupois.

Calculations on the Screw of the Charlemagne.

Pitch.	Radii of elements.	Circumferences normal to radii of elements.	Fract'n used of the pitch.	Lengths of elements for one convolution of the thread.	Lengths used of the elements.	Breadths of the elements.	Helicoidal surfaces of the elements.	Speeds of the elements per second.	Speeds of the elements per minute.	Expression for the frictions of both sides of the elements.
A	B	C	D	E	F	G	H	I	J	K
		$2B \times 3{\cdot}1416$		$\sqrt{A^2 + C^2}$	$\frac{E}{D}$		$F \times G$	$\frac{J}{60}$	$E \times 52{\cdot}26$	$\frac{I^2}{10^2} \times J \times 2\ H$
Feet.	Feet.	Feet.	2·7	Feet.	Feet.	Feet	Sq. Ft.	Feet.	Feet.	
22·957	1·375	8·639	“	24·528	7·008	0·25	1·752	21·364	1281·83	20583·0
“	1·625	10·210	“	25·125	7·179	“	1·795	21·884	1313·03	22567·0
“	1·875	11·781	“	25·807	7·373	“	1·843	22·478	1348·67	25117·6
“	2·125	13·351	“	26·557	7·588	“	1·897	23·131	1387·87	29500·9
“	2·375	14·922	“	27·380	7·823	“	1·956	23·848	1430·88	31835·2
“	2·625	16·493	“	28·267	8·076	“	2·019	24·620	1477·23	36156·8
“	2·875	18·064	“	29·212	8·350	“	2·087	25·444	1526·62	41252·9
“	3·125	19·635	“	30·208	8·631	“	2·158	26·311	1578·67	47168·0
“	3·375	21·205	“	31·252	8·929	“	2·232	27·220	1633·23	54019·2
“	3·625	22·776	“	32·340	9·240	“	2·310	28·168	1690·09	61953·2
“	3·875	24·347	“	33·464	9·561	“	2·390	29·147	1748·83	71017·2
“	4·125	25·918	“	34·623	9·892	“	2·473	30·157	1809·40	81388·8
“	4·375	27·489	“	35·814	10·233	“	2·558	31·194	1871·64	93172·1
“	4·625	29·059	“	37·033	10·581	“	2·645	32·256	1935·34	106520·0
“	4·875	30·630	“	38·278	10·937	“	2·734	33·340	2000·41	121584·0
“	5·125	3 ·201	“	39·546	11·299	“	2·825	34·444	2066·67	138531·0
“	5·375	33·772	“	40·836	11·667	“	2·917	35·568	2134·09	157506·3
“	5·625	35·343	“	42·145	12·041	“	3·010	36·708	2202·50	178662·6
“	5·875	36·913	“	43·470	12·420	“	3·105	37·862	2271·74	202235·0
“	6·125	38·484	“	44·813	12·804	“	3·201	39·032	2341·93	228418·4
“	6·375	40·055	“	46·167	13·191	“	3·298	40·211	2412·69	257319·2
“	6·625	41·626	“	47·536	13,582	“	3·395	41·404	2484·23	289165·0
“	6·875	43·197	“	48·918	13·977	“	3·494	42·608	2556·45	324319·0
“	7·125	44·767	“	50·310	14·374	“	3·593	43·820	2629·20	362790·0
“	7·375	46·338	“	51·712	14·775	“	3·694	45·041	2702·47	405045·0
“	7·625	47·909	“	53·122	15·178	“	3·795	46·270	2776·16	451113·0
“	7·875	49·480	“	54·550	15·586	“	3·896	47·513	2850·78	501462·0
“	8·125	51·051	“	55·980	15·994	“	3·999	48·759	2925·52	556280·6
“	8·325	52·308	“	57·126	16·350	0·15	2·452	49·757	2985·41	362462·4
										5259145·4

$$\frac{5259145{\cdot}4}{33000} = 159{\cdot}368, \text{ and } \frac{124{\cdot}250}{159{\cdot}368} = 0{\cdot}7796$$

Relation between the Piston Pressure and the Thrust of the Screw.—It is evident that, in general, every pressure or power must be balanced by an equal and opposite resistance. The mechanical effect of a pressure is estimated by multiplying that pressure by the space through which it acts; and the mechanical effect of a resistance is estimated by multiplying that resistance by the space through which it acts. Hence, any pressure exerted on the piston of a steam cylinder, and multiplied by the space through which it acts in a given time, must exactly equal or balance the resistance multiplied by the space through which it acts in the same time. It is plain that this *general* law is entirely independent of the absolute velocities of the pressure and resistance, and that the equality will always obtain, be those absolute velocities relatively what they may.

Let us apply the above to the case of a screw actuated by a steam engine, and propelling a vessel; and let us first examine the manner in which the power of the engine is employed, premising that we know the total indicator pressure on the pistons. That total pressure is the primitive force of the steam, without loss from its transmission by the machinery. That transmission, however, cannot be effected without one loss common to all machinery, and independent of any waste in function of the machine itself, viz: the loss by *friction.* It is plain, that before the engine can move at all—that is, before it can develope power—the pressure on the piston must be more than sufficient to overcome *all* the friction resistances acting against it. In the case of propelling a vessel by the screw, which is a simple and perfect machine, operating no loss of useful effect in function of form, *all* these friction resistances will be the friction of the engine, *per se*, the friction of the load, and the friction of the screw surface on the water. It is then only what remains of the total piston pressure after deducting all these friction resistances, which is transmitted by the engine to the screw for the propulsion of the vessel; the application of this remainder of the pressure causes the screw to revolve, and thus transmit this pressure to the water in which the screw acts. The screw, therefore, transmits to the water *all* the pressure it received from the engine, and this pressure will, for one revolution of the screw, act through the length of the screw's pitch. Hence, the resistance per revolution of the screw will equal the pressure in pounds exercised by (or the result of) the screw, multiplied by the pitch of the screw, or the distance through which the resistance acts per revolution of the screw. From the foregoing it is also clear, that the power exerted to balance this resistance will be that aggregate pressure in pounds on the piston, which is left after deducting for all the friction resistances, multiplied by the space through which it acts, while the screw is making one revolution. This space will be the length of a double stroke of piston, when the engine is connected directly to the screw shaft without gearing.

From the above it is also plain, that the more or less slip of the screw does not modify or destroy the equality stated, because as the pressure of the screw is simply upon the water, it is immaterial whether the water on which the screw presses yields, and is forced back by the screw, (to which the name of slip is given,) or whether it remains unyielding, and the screw advances forward with any load whatever attached—the ves-

sel for instance—therefore, the pressure or thrust of the screw in both cases must evidently be the same, because it is solely the effect of, and must be balanced by the piston pressure. Hence also follows, that the pressure exercised by the screw upon the yielding water, must also exactly equal the pressure exercised by the screw upon the vessel in forcing it forward; consequently the power transmitted by the engine to the screw will be divided relatively between the slip of the screw and the propulsion of the vessel, in the ratio of the spaces through which the slip recedes and the vessel advances in equal time. Thus it is seen that neither the slip of the screw, nor the absolute speed of the screw, engine pistons, or vessel, can modify or destroy the equality subsisting between the thrust of the screw and the pressure on the pistons.

From all the foregoing, then, we derive *that the thrust of the screw in pounds, by dynamometer, multiplied by the space through which that thrust acts in a given time, is always equal to what remains of the total piston pressure after deduction has been made of the pressure required for overcoming all the friction, resistance of engine, load, and screw surface on the water, multiplied by the space through which said remainder of piston pressure acts in the same time.*

The experiments with the *Charlemagne*, are arranged in the Table of Results, in six columns, and were made with different velocities of engines' pistons, and of vessel. They will furnish a very good practical test, not only of the truth of the above law, but also of the accuracy of both the observed data and of the calculation based on it. The *Charlemagne* has four steam pistons, whose aggregate area amounts to 8251·6 square inches; the length of the double stroke of piston is 6·562 feet. The pitch of the screw is 22·957 feet, and the screw makes one revolution to each double stroke of piston.

The computation for the pressure required to overcome the friction resistance for the following different volumes, has been made from the data of the 5th column. The pressure required to work the engine alone is taken to be the direct ratio of the speeds of the piston. The pressure required to overcome the friction of the load is taken at Morin's coefficient of 0·075 of the total indicator pressure. The pressure required to overcome the friction of the screw is taken to be in the ratio of the squares of the velocities of the screw. The following are the detailed results, viz:

FIRST COLUMN.

Speed of the vessel, ...	8·793 knots pr. hour.
Revolutions of the screw, ...	49·77 per minute.
Mean effective pressure per square inch of pistons, .	11·35 pounds.
Friction of the engines per square inch of pistons, 1·19 pound.	
" load " " " 0·85 "	
" screw " " " 1·38 "	
Total friction resistances per square inch of pistons, ——	3·42 pounds.
Mean effective pressure per square inch of pistons, after deducting friction resistances, . . .	7·93 "
Thrust of the screw in pounds by dynamometer, .	18531.
Expression for the power, (8251·6 × 7·93 × 6·562 =) .	429385·7
Expression for the resistance, (18531 × 22·957 =)	425116·2

SECOND COLUMN.

Speed of the vessel, ...	8·679 knots pr. hour.
Revolutions of the screw, ...	46·88 per minute.
Mean effective pressure per square inch of pistons, .	11·06 pounds.
Friction of the engines per square inch of pistons, 1·12 pound.	
" load " " " 0·83 "	
" screw " " " 1·30 "	
Total friction resistances per square inch of pistons,——	3·25 pounds.
Mean effective pressure per square inch of pistons, after deducting friction resistances, . . .	7·81 "
Thrust of the screw in pounds by dynamometer, .	17919.
Expression for the power, (8251·6×7·81×6.562=)	422888.1
Expression for the resistance, (17949×22·957=)	412055.2

THIRD COLUMN.

Speed of the vessel, ...	8·240 knots pr. hour.
Revolutions of the screw, . . .	47.10 per minute.
Mean effective pressure per square inch of pistons, .	10.18 pounds.
Friction of the engines per square inch of pistons, 1·13 pound.	
" load " " " 0·76 "	
" screw " " " 1·31 "	
Total friction resistances per square inch of pistons,——	3·20 pounds.
Mean effective pressure per square inch of pistons, after deducting friction resistances, . . .	6.98 "
Thrust of the screw in pounds by dynamometer, .	16483.
Expression for the power, (8251·6×6·98×6·562=)	377946·1
Expression for the resistance, (16483×22·957=)	378400·2

FOURTH COLUMN.

Speed of the vessel, ...	6·995 knots pr. hour.
Revolutions of the screw, ...	36·43 per minute.
Mean effective pressure per square inch of pistons, .	8·41 pounds.
Friction of the engines per square inch of pistons, 0·87 pound.	
" load " " " 0·63 "	
" screw " " " 1·01 "	
Total friction resistances per square inch of pistons,——	2·51 "
Mean effective pressure per square inch of pistons, after deducting friction resistances, . . .	5·90 "
Thrust of the screw in pounds by dynamometer, .	13341. "
Expression for the power, (8251·6×5·9×6·562=)	319467·3 "
Expression for the resistance, (13341×22·957=) .	306269·3

FIFTH COLUMN.

Speed of the vessel, ...	9·523 knots pr. hour.
Revolutions of the screw, ...	52·26 per minute.
Mean effective pressure per square inch of pistons, .	12·09 pounds.
Friction of the engines per square inch of pistons, 1·25 pound.	
" load " " " 0·91 "	
" screw " " " 1·45 "	
Total friction resistances per square inch of pistons,——	3·61 pounds.
Mean effective pressure per square inch of pistons, after deducting friction resistances, . . .	8·48 "
Thrust of the screw in pounds by dynamometer, .	20000.
Expression for the power, (8251·6×8·48×6·562=)	459166·6 "
Expression for the resistance, (20000×22·957=) .	459140·0 "

SIXTH COLUMN.

Speed of the vessel,	. . . .	8·793 knots pr. hour.
Revolutions of the screw,	. . .	50·70 per minute.
Mean effective pressure per square inch of pistons,	.	12·09 pounds.
Friction of the engines per square inch of pistons, 1·21 pound.		
" load " " 0·91 "		
" screw " " 1·45 "		
Total friction resistance per square inch of pistons,——		3·57 pounds.
Mean effective pressure per square inch of pistons, after deducting friction resistances,	. . .	8·52 "
Thrust of the screw in pounds by dynamometer,	.	20000.
Expression for the power, (8251·6×8·52×6·562 =)		461332·4
Expression for the resistance, (20000×22·957=)	.	459140·0

The reader will not fail to observe how very closely in each case the "expression for the power" agrees with the "expression for the resistance."

It also follows from the foregoing law, that the thrust of the screw is always in the direct ratio of the effective piston pressure, and that it will always be the same with the same remainder of the piston pressure after deducting all the friction resistances, let the speed of the screw or the load upon it be what they may. It will be the same with the vessel under way, towing, or tied to the dock. This can be practically tested by taking from the six trials with the *Charlemagne* the thrusts by the screw, and dividing them by the mean effective pressure that remains after deducting the friction resistances, when the quotients will be found to be nearly equal. Had the data been exact, the quotients would have been exactly the same. The results are as follows, viz:

	Revolutions made by the screw per minute.	Mean effective pressure in pounds per square inch on the pistons after deducting all the friction resistances.	Thrust of the screw in pounds by Dynamometer.		
1st column,	49·99	7·93	18531	and	$\frac{18531}{7·93}$=2336·82
2d column,	46·88	7·81	17949	"	$\frac{17949}{7·81}$=2298·21
3d column,	49·10	6·98	16483	"	$\frac{16483}{6·98}$=2361·46
4th column,	36·43	5·90	13341	"	$\frac{13341}{5·90}$=2261·18
5th column,	52·26	8·48	20000	"	$\frac{20000}{8·48}$=2358·49
6th column,	50·90	8·52	20000	"	$\frac{20000}{8·52}$=2347·42

Evaporation by the Boiler.—An experiment was made to ascertain whether any economy in fuel would be effected by slower combustion, and using more boiler. The result is given in the 4th column of the Table of Results, and it was found that by hard firing and burning at the rate of 32·829 tons of coal per 24 hours, *two* boilers could be made to

produce sufficient steam to maintain a boiler pressure of 3·68 pounds per square inch above the atmosphere, with 36·43 revolutions of the screw per minute; while with *three* boilers, or 50 per centum more, the same amount of steam was furnished by burning at the rate of 28·490 tons of coal per 24 hours, or $13\frac{1}{5}$ per centum less than the former amount, (32·829 tons.)

The following evaporation by the boilers has been calculated from the mean of the data in the 5th and 6th columns of the Table of Results, where the throttles were carried wide. The steam pressure in the cylinders, before cutting off (at $\frac{7}{10}$ the stroke from the commencement), averaged 1·6 pound per square inch above the atmosphere. The steam space comprised in the cylinder nozzles, clearance, &c., at *one* end of the *four* cylinders, is taken at 10 cubic feet. The loss by *blowing-off* is calculated for maintaining the sea-water in the boilers at twice the natural concentration, and is included in the evaporation. The temperature of the feed water is taken at 100° Fahr. Double stroke of pistons 51·78 per minute, and Regnault's determination of the latent heat of steam is used. The following are the results, viz:

Cubic feet of steam of atmospheric pressure furnished per minute under the above conditions, ...	18070·74
Pounds of steam evaporated per hour by one pound of coal under the above conditions, ...	6·95

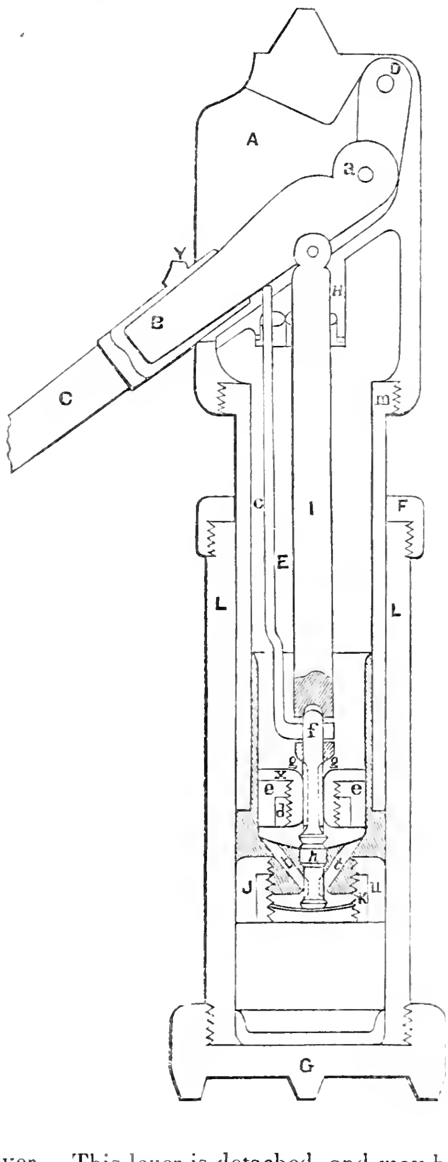
Under the ordinary conditions of practice, there would be found a considerable decrease of the above evaporation, reducing the units of steam to about 6·50 per unit of coal, instead of 6·95; because during the above experiment, the longest run being only $14\frac{1}{2}$ hours, and the run from which the data is taken only $10\frac{1}{2}$ hours, there could have been but very little, if any, cleaning of fires, and also much less *blowing-off*, than in a long run of days, as the vessel would start with full boilers of sea-water of the natural concentration.

For the Journal of the Franklin Institute.

Dudgeon's Patent Hydraulic Press.

This ingenious and useful apparatus was patented July 8th, 1852, and is becoming extensively introduced as a substitute for the old jack screw. The advantages it possesses are, 1st, Its lightness, which makes it easy for one man to shoulder a press capable of raising ten tons. 2d, The small power required to work it, every press being arranged so that one man can raise the weight for which the press is calculated. This advantage must be obvious, when we reflect that the friction of the old jack screw, which is enormous, particularly when the oil has been gummed by cold or dirt, is replaced by the very trifling friction incident to the passage of the fluid in the press through the openings. 3d, The ease with which heavy bodies may be lowered, which may be effected slowly or rapidly, as desired, by simply touching the relief valve with the working lever. 4th, The convenience of using it in confined situations, where it is difficult or impossible to turn the lever of the screw. To those who are accustomed to the use of the jack screw, and who are therefore acquainted with its inconveniences, the advantages of this press will be evident.

The inventor has proposed to apply the same arrangement to pressing cotton and goods; and indeed he exhibited in the Crystal Palace, New York, a small press of the kind, which appeared to be very convenient, and certainly cheaper than any other form of press with which we are acquainted. We annex a cut of the hydraulic jack, and a description:



The press, or "jack," shown in the cut, presents a cylindrical appearance; it consists of an outer cylinder, or case, resting on the ground, and an inner cylinder, or ram, surmounted by a boss, in which the working lever is pivoted, and which is placed under the object to be lifted, of course moving up with it. The peculiarity of the arrangement is, that the *pump* is within the hydraulic press. The liquid used is oil, of good quality, which, however, ought occasionally to be renewed; and the ram is made hollow, in order to form a reservoir large enough to contain the oil when the jack is down.

The size of the cylinder (inside) varies from two to eight or more inches, according to the weight for which the press is designed; one of $3\frac{1}{4}$ inches will readily lift 10 tons, and can be worked by one man with greater facility than two men could raise the same weight by a jack screw.

The ram, with its head, contains just so much oil or other fluid as is requisite to fill the cylinder when the ram is all the way up; and when it is lowered, the fluid returns again to the original cavity upon the small valve, *h*, being forced open by the lever. This lever is detached, and may be put in at pleasure; it is shown in the cut upside down, and the press is in the act of lowering, so that the lever, by being pressed down, has forced open the small valve, *h*, by the rod, *e*, acting on the piston, *f*. When the

lever is raised, a small spring under the valve, *h*, shuts it, and arrests the descent of the ram. When the ram is to be raised, the lever is taken off, and put in right side up, or with the projection, *y*, downwards; which brings up on the bottom of the slot in which the lever works, and limits its down stroke before it touches the rod, *e*. The force pump barrel, J, is fitted into the lower end of the ram, and its piston, consisting of top and bottom pieces, *x* and *d*, with leather between, is connected by the rod, I, to the lever, B. The valves, *f* and *h*, have gutters or channels cut in their sides, along which the fluid can pass when the valves are down or open; the piston rod, I, is kept in line by passing through the stuffing box, H; and the short link, D, to which the lever is attached, makes a species of parallel motion. The piston and ram and the cylinder bottom are kept tight by cup leathers, as used in hydraulic presses. The action of the pump will be readily seen by reference to the cut. When the ram and piston are both down, both valves are seated. On moving the piston up, the liquid above presses open the valve, *f*, and flows into the cavity under the piston as it ascends. When the lever is again moved, this same liquid shuts the valve, *f*, and opens *h*, flowing beneath the ram, and raising it. This jack may be used either vertically or at any angle with the horizontal line. The head must, however, be slightly raised, to induce the fluid to pass the valves.

For the Journal of the Franklin Institute.

On the Collapsing of a Boiler in the Establishment of C. C. Rheinhardt, at Baltimore, Md., on the 2d day of January, 1854. By Wm. H. Shock, Chief Engineer, U. S. N.

A few hours after the above accident, I happened to be in the vicinity of its occurrence, and by permission examined the boilers as far as was practicable, and the results of its collapsing, *i. e.* the demolishment of a three-story brick building, in which was manufactured various surgical instruments, and of which several thousand dollars worth of unfinished work was totally destroyed, or much injured, the upper story being completely shattered or torn to pieces, rendering necessary, in all probability, a renewal of the walls to their foundation. Doors and windows in remote parts of the building were torn from their hinges—*indeed*, all around were strewn frightful evidence (in this case) of a badly managed agent of wealth and power.

The stock in course of completion comprised a large variety of trusses and fine surgical instruments. A valuable collection of tools, turning lathes, forges, &c., were greatly damaged, or rendered entirely useless. But, *most sad* to relate, six of the employees of the establishment were wounded, two of which cases it is supposed will terminate fatally. It is to be hoped, however, that so sad a termination to the unfortunate circumstance will not ensue.

The boilers were of the upright cylindrical type, (with upright tubes,) eleven feet high and four feet diameter. From the condition of the boiler at the time of my examination, it was impossible for me to get an exact sketch. I herewith send one that I think will not prove far from being correct. It will suffice, however, for our present purpose, *i. e.* as a reference in offering a few reasons as to the probable cause of the above

catastrophe. As a general thing, it is next to an impossibility to collect a correct statement of the attending circumstances of an explosion or collapse. I succeeded, however, in obtaining the following facts from the proprietor of the establishment:

"On Saturday evening, December 31st, the work in the establishment was suspended at the usual hour, and steam blown off. On Monday morning following, the man in charge of the machinery, as was his custom, pumped up the boiler, and started fires, and made his arrangement for starting the engine at 7 A. M., the hour for commencing the day's work, *at which time an effort was made to blow the whistle, but for want of steam failed. No effort had been made to start the engine that morning at all. At five minutes after 7, the explosion took place. One of the wounded men had tried the water gauges at 7 o'clock, (five minutes before the explosion,) and found water in No. 2 gauge, there being four gauges on the boiler. The safety valve was screwed down by a spring balance to 65 lbs. per square inch.*"

Here we have in substance the statement of Mr. Rheinhardt, and from which, with an examination of a piece of the fractured part of the boiler, which I have caused to be forwarded to the Institute for its inspection, some useful information may be obtained in regard to this matter.

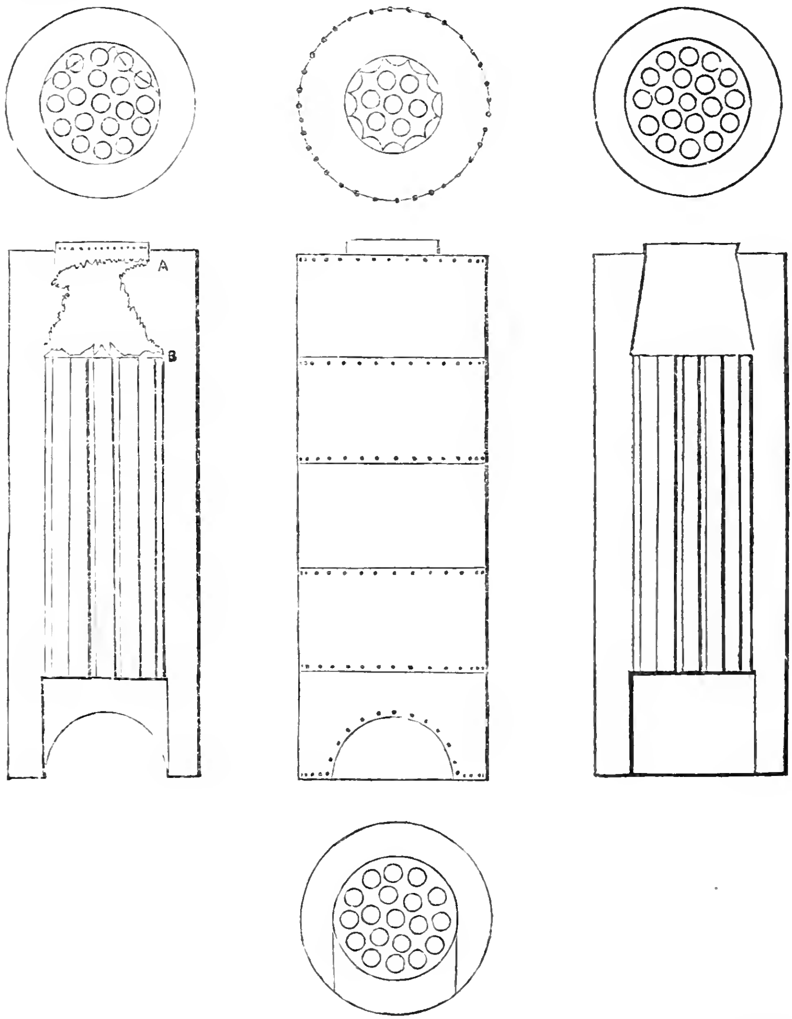
I conclude there is scarcely a doubt as to the fact that the condensed steam collected in the whistle or pipe, or both, had frozen firmly, as it extended above the roof of the building, and was exposed to the cold during Saturday night, Sunday, and Sunday night, and *as it appears his index for the required pressure was to be the blowing of the whistle*, and in waiting for which he committed an error which involves his employer in a serious loss, and perhaps the forfeiture of his own life to his insane proceedings. The safety valve, we are informed, was screwed down to a pressure of 65 lbs. per square inch. Who knows this fact? Mr. R., the unfortunate proprietor, asserts that this was the usual pressure, *but cannot speak advisedly as to the point it was screwed down to on the morning of the collapse;* and although he exonerates his boiler tender from blame in this particular case, yet I am informed by him "*that he was not a careful man as a general thing.*"

The fracture began at or near the top of the boiler, and extended around two-thirds of the circumference of the inner shell, and consequently above the water level, taking a downward direction to the top tube sheet, in a multiplicity of irregular fractures, and finally was crushed down and flattened over each other, and over the upper end of the tubes; and to this fact I attribute such thorough destruction *above the boiler*, as it prevented in a great measure the expanding gases from a downward direction through the tubes, and thence out through the furnace doors. As farther reasons for this disaster, I do not consider the iron to have been of a good quality, as will be seen from the piece submitted. I am also of the opinion it was not thick enough, particularly in the absence of all bracing. About the fractured part, it may be offered that bracing in a cylindrical boiler of these dimensions is unnecessary for a pressure of 65 lbs. per square inch. Well, under certain conditions, I would agree with them, but those conditions would have to be—

1st. The boilers to be made of the best quality of iron, *and not mixed.*

2d. To be of a proper thickness.

3d. The safety valve to be properly loaded, and *made inaccessible not only to the boiler tender, but to the owner himself,* and should be inspected by a competent person at specified times, who should be appointed by law, for I can see no good reason why citizens and their property should not be protected from ignorance or wilful neglect of those in charge of steam boilers in our thronged cities, as well as those whom duty or pleasure may call from their homes on our rivers or across the sea. I consider such protection to their property from accidents such as we have just stated, to be a legitimate subject for the legislators of our State government at least.



In the accompanying sketch it will be observed, as before stated, that the fracture began at or near the top of the boiler, at letter A, and was crushed down on the top tube sheet B.

For the Journal of the Franklin Institute.

Particulars of the Steamer Charles Morgan.

New York.—Hull built by Westervelt & Son. Machinery by Morgan Iron Works. Owners, Harris & Morgan. Intended service, Gulf of Mexico.

Hull.—	
Length on deck,	215 feet.
Breadth of beam at midship section,	34 "
Depths of hold,	10 & 17 "
Length of engine and boiler space,	74 "
Draft of water at load line,	9 "
" " " below pressure and revolutions,	7 "
Floor timbers at throats, moulded,	11 inches.
Do. do., sided,	14 "
Distance of frames apart at centres,	28 "
Capacity of coal bunkers, in tons of coal,	200
Masts and rig,	Foretopsail schooner.
Engine.—One—vertical beam.	
Diameter of cylinder,	5 feet.
Length of stroke,	11 "
Maximum pressure of steam in pounds,	20
" revolutions per minute,	20
Boilers.—Two—single return flued.	
Length of boilers,	29 feet.
Breadth "	10 " 9 inches.
Height " exclusive of steam chimney,	11 " 3 "
Number of furnaces,	6
Length of grate bars,	7 "
Diameter of smoke pipe,	6 " 3 "
Height of smoke pipe,	42 "
Number of flues,	16
Internal diameter of flues,	17½, 17, 16, and 12 "
Heating surface in sq. feet.	5000
Description of coal,	Bituminous.
Water Wheels.—	
Diameter,	31 feet 3 inches.
Length of blades,	8 "
Depth "	1 " 8 "
Number of blades,	26

Remarks.—Hull strapped with iron braces, $4 \times \frac{5}{8}$ inch.

For the Journal of the Franklin Institute.

The Mineral Contents of the Lower Sandstone of the Upper Mississippi. Condensed from Dr. Owen's Geol. Survey of Wisconsin, &c. By Dr. L. Turnbull.

According to Dr. Owen's experience in other mining districts, the country over which this light colored quartz ore sandstone prevails, is not likely to be very productive in mineral deposits; yet between the Mississippi and Kickapoo Rivers, on the southeast quarter of Section 27, Township 10, North, Range 5, West, of the 4th Principal Meridian, copper ore has been discovered, not, however, in immediate connexion with the sandstone. The wall-rock to which the ore was traced, and which bounds it on the south-east, is a magnesian limestone, possessing

all the characters usual in the lead and copper localities of the rich Mineral Point district.

This copper ore has a light green color, waxy lustre and fracture, and very brittle, disseminated through ferruginous earthy matter, composed chiefly of brown oxide of iron. The following is the analysis by Dr. Owen, of this ore, in the usual way, gave from a gramme:—

Water,	11·2
Carbonic acid,	05·0
Insoluble silicates, traces of oxide of iron,	08·3
Protoxide of copper,	25·0
Peroxide of iron,	48 7
Protoxide of manganese,	00·2
Alumina,	00·6
Carbonate of lime,	00·8
Loss,	00·2
	100·0

=19·87 per cent. by calculation, of metallic copper.

Smelted by Wm. Preston, at Mineral Point, it yielded 23 per cent. of metallic copper, being only three per cent. more than the result of Dr. Owen's analysis.

This ore was first discovered by a Mr. Sterling, in March, 1843, on the north slope of a hill, the foot of which is watered by Cooper creek, a small tributary which runs west, into the Mississippi, four and a half miles from the Kickapoo. It was explored by Mr. Sterling, and proved to be a bed from 12 to 15 feet wide, and five to seven deep, spreading out as it descended the slope, to 30 feet wide, and conformable to the outline of the hill. On tracing it to the south, it was followed to near the brow of the hill, where it pitches to the southeast, parallel with a wall of magnesian limestone, and almost perpendicularly. The wall of magnesian limestone is quite solid, and without apparent stratification. A shaft of 50 feet was first sunk from the surface; then a drift of 90 feet was run on the west side of the perpendicular wall of rock; and afterwards another shaft of 12 feet at the end of the drift. To the north, a gallery was run 40 feet, and six feet sunk perpendicularly; the copper ore extending both horizontally and vertically, as far as these excavations were carried.

The mine lies well for drainage, and the ore is of a kind easily reduced in the furnace, and yields so good a per centage of copper (about 20 to 23 per cent.) that it would be well worth the expense to prove this mine further than has yet been done, so as to determine to what extent the ore traverses the magnesian limestone before entering the sandstone, in which latter formation the vein would probably dwindle, or entirely disappear. Mr. Sterling has transported 24,000 lbs. of the ore to Mineral Point, and had it smelted, with the results as given above.

Carson & Sterling, of Mineral Point, subsequently discovered copper ore of a similar quality on the same quarter section, only 300 yards north of the ore bed just described.

On Section 1, Township 12, and Range 4, east of the 4th Principal Meridian, copper ore has been found, in the vicinity of the Barraboo River, disseminated in pockets through brown ferruginous beds of sandstone,

occurring towards the base of F 1. It is a green carbonate and silicate of copper, similar in character to that occurring near Mineral Point.—*Owen's Geol. Survey.*

Copper Ore in the Lower Magnesium Limestone.—Between Plum and Pine Creek, in the south west corner of Section 26, Township 8, North, Range 5 West, of the 4th Principal Meridian, on the south east slope of a hill, copper ore, associated with hematite, was found, and traced into a crevice traversing the lower cherty beds of the formation; also four, miles beyond, in a N. N. W. direction, on the slope of another hill, copper ore was picked up, and yielded, by analysis, from 17 to 23 per cent. of copper.

To be Continued.

For the Journal of the Franklin Institute.

Particulars of the Steamer Sonora.

New York.—Hull built by Westervelt & Son. Machinery by Morgan Iron Works. Owners, Pacific Mail Steamship Company. Intended service, Pacific.

Hull.—		
Length on deck,		264 feet.
Breadth of beam at midship section,		36 "
Depths of hold,	17 feet 3 in. and 24 "	6 inches.
Length of engine and boiler space,		66 "
Draft of water at load line,		12 "
Draft of water at below pressure and revolutions,		7 "
Floor timbers at throats, moulded,		16 inches.
" " sided,		14 "
Distance of frames apart at centres,		28 "
Masts and rig,	Foretopsail Schooner.	
Engines.—Two—Vertical beam.		
Diameter of cylinders,		50 inches
Length of stroke,		10 feet.
Maximum pressure of steam in pounds,	20	
Maximum revolutions per minute,	20	
Boiler.—Two—single return flued.		
Length of boilers,		30 feet.
Breadth "		13 "
Height " exclusive of steam chimney,		12 "
Number of furnaces,	6	
Length of grate bars,		7 "
Number of flues,	28	
Internal diameter of flues,	16, 15, 13, and 10 inches.	
Diameter of smoke pipe,		6 feet 9 "
Height of smoke pipe,		42 "
Description of coal,	Bituminous.	
Water Wheels.		
Diameter of water wheel,		30 feet.
Length of blades,		9 "
Depth "		16 inches.
Number "	26	

Remarks.—Guards fore and aft; hull strapped with iron braces, 4 × $\frac{5}{8}$ inches.

For the Journal of the Franklin Institute.

Particulars of the Steamer Orizaba.

New York.—Hull built by Westervelt & Sons. Machinery by Morgan Iron Works. Owners, Charles Morgan & others. Intended service, Gulf of Mexico.

Hull.—		
Length on Deck,	240 feet	
Breath of Beam,	34 "	8 Inches.
Depth of Hold,	17 "	
Length of Engine and Boiler space,	76 "	
Draft of water at load line,	11 "	
" " below pressure and revolutions,	7 "	
Floor Timbers at throats, molded,		14 "
" " sided,		14 "
Distance of frames apart at centres,		28 "
Masts and Rig	Foretopsail schooner.	
Engine.—One—Vertical beam.		
Diameter of Cylinder,		65 "
Length of Stroke,	11 "	
Maximum pressure of steam,	20 lbs.	
" revolutions,	20 per min.	
Boilers.—Two—Return flued.		
Length of Boilers,	30 "	
Breadth of Boilers,	12 "	
Height of Boilers, exclusive of steam chimney,	15 "	
Number of Furnaces,	6	
Length of Grate Bars,	7 "	6 "
Number of flues,	16	
Internal Diameter of flues,	15, 17½ and 13½ "	
Diameter of smoke pipe,	6 "	9 "
Height of smoke pipe,	42 "	
Fire surface,	4000 "	
Natural draft to furnaces,		
Description of coal,	Bituminous.	
Water Wheels.		
Diameter,	30 "	
Length of Blades,	9 "	
Depth of Blades,	1 "	10 "
Number of Blades,	26	

Remarks.—Hull strapped with iron diagonal and double laid braces, 4 by $\frac{5}{8}$ inches, floors filled in solid.

For the Journal of the Franklin Institute.

Note on the Absolute Elimination of the Flexion of Telescopes. By M. Porro.

[Read before the Academy of Sciences of Paris, 14th November, 1853.]

Taking advantage of the indeterminateness of the problem of achromatism, I introduced into the calculation of the radii of curvature of an object-glass, the condition that the radius of curvature of the fourth surface,

should be equal to the focal length. By this I obtained, by reflexion at the focus, an image of the reflected wires which permits the determination of the point on the optical axis, independent of the figure of the tube; it was then sufficient to connect the alidade circle with the object-glass only; the eye-piece might be placed on a separate support, supplied with the necessary movements, and then the tube plays no part in the determination of the collimation line of the telescope, and there is no longer any occasion to concern ourselves about its flexion.

It will be, perhaps, remembered that on the occasion of the construction of a large equatorial for the Technomathic Institute, I communicated to the Academy, a mode of reducing the flexion to a very small quantity; the leisure left me by the suspension of the work of constructing the equatorial in question, permitted me to obtain this means of annulling it completely; but the work was already too far advanced to apply the new improvement.

I will show, in another memoir, how a purely optical phenomenon, similar to the above, will permit the astronomer to determine, first, without circles or divisions, the absolute directions of the visual rays placed at all apozeniths from 30° to 30°, then to decide optically, by means of an arc of 30° only, the intermediate apozeniths to the small fractions.

The substitution of a purely optical determination for those dependent on the figure and adjustments of the metallic parts, appears to me to be the *nec plus ultra* of the improvements which can, at the present day, be desired in astronomical instruments.

For the Journal of the Franklin Institute.

The Ericsson

Has again actually turned her wheels, and judging from their speed (or rather slowness), has made as many as four or five turns per minute at the wharf. Her owners decided not to take the place of the Humboldt (although they applied for it) as she could not be got ready in time. The getting ready of an Ericsson Air Engine being a job of some magnitude; about four weeks having already been consumed in working up to five revolutions. It may be gratifying to steam engineers to know, that they have a small steam engine on board to fill their receivers, although why a small air engine would not have done the duty, is, to those not in the secret, a puzzle.

P. S.—We observe by the New York papers, that after hauling out in the stream, preparatory to a trial trip, the ship has returned to her dock.

X. Y. Z.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, January 19, 1854.

G. W. Conarroe, Esq., President, P. T., in the chair.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from Prof. E. N. Horsford, Cambridge, and Mass. Charitable Mechanics Association, Boston, Mass.; M. W. Baldwin, and G. H. Hart, Esqrs. Penn. Legislature; The Mechanics Institute, Chicago, Illinois; and Messrs. Lindsay and Blakiston, Blanchard and Lea, and Dr. L. Turnbull Philadelphia.

Donations to the Cabinets from Dr. P. Shumberg, Sarah Furnace, Blair Co. Penna.; W. H. Shock, Esq., Chief Engineer U. S. Navy; and M. B. Smith and C. W. Packer, Esqrs. Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement for December; and also his annual statement for 1853.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Publications reported their annual satement of the condition of the Journal of the Institute.

The Committee on Exhibitions presented printed copies of their report on the late Exhibition.

New Candidates for membership in the Institute (3), were proposed, and those proposed at the last meeting (10), were duly elected.

The Tellers of the annual election for Officers, Managers, and Auditors, for the ensuing year, reported the result, when the President declared the following gentlemen as duly elected:—

Samuel V. Merrick, President.

Thomas Fletcher, } Vice Presidents.
Abraham Miller, }

Isaac B. Garrigues, Recording Secretary.

John C Cresson, Corresponding Secretary.

John F. Frazer, Treasurer.

MANAGERS.

Matthias W. Baldwin,	Isaac S. Williams,	Wm. D. Parrish,
Frederick Fraley,	Henry P. M. Birkinbine,	Frederick Graff,
John Agnew,	George W. Conarroe,	Thos. S. Stewart.
John H. Towne,	Thomas J. Weygandt,	John E. Addicks,
Edwin Greble,	Joseph J. Barras,	John McClure,
David S. Brown,	George N. Eckert,	Jos. Harrison, Jr.
Owen Evans,	Charles E. Smith,	George Erety,
Alan Wood,	John C. Trautwine,	Evans Rogers.

AUDITORS.

Samuel Mason, Algernon S. Roberts,
James H. Cresson.

G. W. Smith, Esq. drew the attention of the meeting to certain errors which he had detected in the experiments of Lieut. Drummond with the lime light in which a Committee of the Trinity House Board and certain members of the Royal Society had assisted. These experiments are contained in the Philosophical Transactions, London, June 17, 1830 vol. cxx, p. 383.

The lime ball, or cylinder, was $\frac{3}{8}$ inches diameter, with two jets of oxygen and hydrogen gas directed on it, the illuminating power was equivalent to 13·5 Argand lamps-$\frac{7}{8}$ inch in diameter, equal only to $6\frac{3}{4}$ such lamps for each jet, as manifestly appears in page 390, nevertheless in the latter part of the same page, the intensity of the lime light is stated at no less than 264·1 of such Argand lamps; now the mode by which this apparent result was obtained, was "by screening the different lights, and then placing *equal* apertures opposite each:" now this was literally placing as it were one of the lights under a bushel, for the aperture being small would permit the whole light from the lime ball to fall upon the screen, while the smallness of the aperture would effectually cut off by far the larger portion of the light emitted by the flame of the large* four wick, Fresnell lamp, the flame of which is nearly four inches in diameter by six in height. Relying on this erroneous mode of measurement, Lieut. Drummond came to the conclusion that the intensity of his lime light, was equal to 264 common Argand lamps, when his own previous experiment conclusively proved it to be equal to only 13·5.

Dr. B. H. Rand, inquired of Mr. Smith the greatest distance at which the Drummond light had ever been seen. A referrence to vol. cxvi of the Philosophical Transactions, page 334, states that it has been seen at the distance of $66\frac{1}{4}$ miles; Dr. R. inquired of Mr. S. the maximum distance at which the Fresnell light had been observed, Mr. S. stated, that the Skerryvore light had been distinctly seen by the unassisted eye, from the Summit of Ben Nevis, a distance exceeding 90 miles.

Mr. Smith mentioned that the number of miles of Railroad completed in the United States, including also such as will be finished in the spring of the present year, was over 18,000, and that a larger amount had been finished in the United States during the last year than in all the world during the same period.

Mr. Fairman Rogers exhibited a model of a cast iron coffer dam, invented by Mr. Joseph Clark, of Pennsylvania. The inventor proposes to use cast iron piles in the formation of the dam, fitting into each other by a species of dovetailed tongue and groove along their sides, and adjustable to different heights, in order to fit the irregularities of a rock bottom, for which it is specially intended. The transverse section of each pile is that of a voussoir of an arch, and when joined they form a circular or segmental dam of a radius adapted to the space to be enclosed.

The pressure of the water on the outside is resisted by the arch formed by these piles.

The joints to be made tight by the use of any very viscous grease.

* This lamp is equal to 17 common Argands.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. McRea's Railroad Drawbridge and Switch Safety Telegraph.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, a "Railroad Drawbridge and Switch Safety Telegraph," invented by Wm. C. McRea, Esq., of Philadelphia, Pennsylvania—Report:

That in this contrivance an electrical current is arranged so as to be closed when the drawbridge or switch is in proper position, and to be broken when this is not the case. The wire terminates in a rail carefully insulated from the rest of the track, and at such a distance from the bridge as to allow ample room for stopping the train of cars between them. The next rail to the one spoken of is also insulated from the track, and connected with one of the ground plates of the circuit. On the locomotive is placed an electro-magnet of the ordinary construction, whose keeper controls the works of an alarm, so that the bell, stopped while the keeper is not attracted by the magnet, is released and allowed to ring the moment that this attraction takes place. The wire of the coil terminates in metallic connexion with the front and hinder axles of the locomotive. And it will be easily seen that when the locomotive reaches such a point, that the fore wheels are on one of the insulated rails, and the hind wheels on the other, the electric circuit (provided the drawbridge is closed) is completed through the magnet, and the bell rings, indicating that it is safe to proceed; but if the drawbridge or switch is open, the bell will not ring, for the electric circuit is not closed, and the conductor is warned to stop or to proceed with caution.

The means proposed for obtaining this important end are simple, and not expensive, and the idea is certainly a very ingenious one; and it will be observed that the result of any failure in the apparatus is simply to excite the cautiousness of the conductor. This safety signal cannot be given unless every thing is in order. This constitutes, in the opinion of the Committee, the very great merit of the contrivance. In practice, the difficulties which suggest themselves, will be in perfectly insulating the rails, especially in low situations, and in very wet or icy weather; and, secondly, in arranging the extremities of the magnetic coil so that the current from the wire will pass through them. There can be little doubt that the grease on the well oiled axle of a locomotive will prevent the passage of an electric current of such feeble intensity, and if it did not, it would pass through the pedastals and iron work of the engine to the other axle, and thus escape the magnetic circuit. But the avoidance of this objection will probably be easy; and the simplicity of the apparatus and importance of the result to be obtained, thereby recommend Mr. McRea's invention to a practical trial.*

* As soon as these objections were proposed to the inventor, he suggested a mode of obviating both of them by terminating one end of the magnet coil on a rod projecting downwards from the cow catcher, the other in a rod projecting similarly from the hinder frame of the engine, and setting the insulated rails in the middle of the track, where they can easily be completely insulated.

It would also be advisable that a signal should be given to the switch or bridge tender, to prevent the possibility of his opening the switch or bridge after the engine had passed the signal station, but before reaching the point of danger.

Mr. McRae has also proposed a modification of the apparatus for avoiding the collision of trains on a single track road. At the turn-out at each extremity of the part of the track on which the trains may meet, the insulated rails are prepared as before, but at each point the line is provided with a "circuit changer," as shown in the accompanying drawing; the battery has a double circuit, each including one of these 'circuit changers.'

The ordinary position of the "*circuit changer*" is such that the current to which it belongs is interrupted. Now, the conductor of the train who first arrives at one end of the prepared track, shifts the "*circuit changer*" by a simple motion, and thus passes a current from the distant station through his magnet, and the ringing of the bell indicates that he may proceed in safety. In proceeding, he leaves the *circuit changer* in its new position, by which the circuit at that end is broken. If, now, while he is on the doubtful ground, the other train arrives, and the conductor shifts the *changer* at that end, he can get no circuit, and, consequently, his bell is silent; for it will be seen by the drawing that the current must come from the far station, and that has been thrown out by the first train in passing; he must therefore wait. As the trains pass off the ground they must stop to readjust the *circuit changers* in their first positions. It will be seen here again, that any failure of the apparatus, or negligence in its adjustment, can only produce delay, and that, provided the first conductor performs his duty, a collision is impossible. These changes may, it is manifest, be easily made by the locomotive itself, if that be deemed desirable. The Committee therefore report, that the invention of Mr. McRae appears to present a simple and not expensive means of adding materially to the safety of railroad traveling; and that it is, in their opinion, worthy of trial in practice, which is the only thing which can finally decide upon its utility, and they recommend that a description of the instrument be published in the *Journal* of the Institute.

By order of the Committee,

WM. HAMILTON, *Actuary.*

Philadelphia, October 15th, 1853.

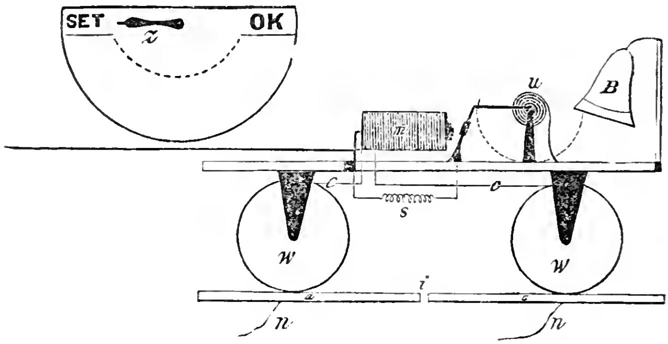
Description by the Inventor.

The mode of arrangement is, to extend a wire from a battery across the drawbridge, to a safe distance on each side, and there connect to an insulated rail in the track.

When a train of cars approaches the bridge from either side, so that the wheels *w w*, fig. 1, touch the track *a a*, at opposite sides of the insulation *i*, if the draw is closed, a circuit will be completed; *n n*, are the wires which extend from the battery and connect with the track; *c c*, are wires which connect the circuit from the wheels to the electro-magnet *m*. When a circuit is formed, the armature *x* will be so attracted as to release the hammer *y*, which will be acted upon by the spring *u* so as to strike the bell B. The shaft to which the hammer is fastened carries with it the hand *z*, as seen upon the index in fig. 2, so that when the circuit is closed the hand will paint to "O K." When the circuit is broken the armature will fall into its former position by aid of the spiral springs,

when the hand of the index is to be turned back to "*Set*," by which the instrument is adjusted for use.

Fig. 2. Fig. 1.



If the draw of the bridge be open when a train approaches it, the circuit will not be completed in consequence of the separation of the wire at the draw; therefore, the bell cannot ring, and the hand on the index will remain pointing to the word "*Set.*"

The same plan of galvanic connexions, as also the same instrument, are applicable to the prevention of accidents at railroad switches; as by the displacing of a switch, the same effect may be produced upon the galvanic circuit as by the opening of a drawbridge.

By means of a different plan of connexions, the same apparatus may be used for the purpose of indicating to persons on board of one train as to whether an approaching train has passed a given point of the road or not.

Figures 3 and 4 represent prepared places in the track, as seen in fig. 1: *g* is the ground wire leading from the track on one side of the insulation *i*; *e* is a wire which is attached to the track, opposite the ground wire, and which forms part of the main line; when the "circuit changer" *t* is removed from the battery wire *b*, and placed so as to connect it with the wire M, which extends to the next turn-out.

Fig. 3.

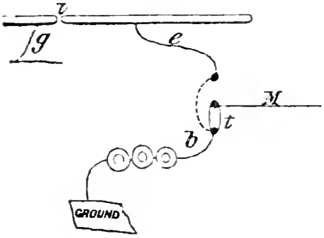
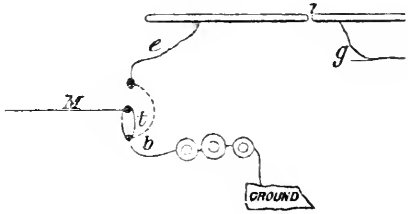


Fig. 4.



On the arrival of a train at one of the prepared places, by shifting the circuit changer *t*, from the point where it connects with the battery wire *b*, so as to connect with the wire *e*, a current will be passed through the

magnet upon the car from the battery at the distant station, causing the bell to ring, which indicates that they can proceed in safety. The circuit changer is to be left in its new position, so that when the approaching train arrives at the next turn-out, no circuit can be obtained which indicates that said train must wait.

As the trains pass off the ground, the circuit changers must be placed in the original position.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, an "Improvement in Stereotyping," invented by Jason M. Mahan, of Philadelphia, Pennsylvania—Reports

That the improvements claimed are fully set forth in the drawings and specification herewith submitted.

They are twofold; 1st, In the construction of a furnace, in which the metal is melted, the caster for containing the moulds heated, and the plaster moulds dried by the same fire. This arrangement is ingenious and satisfactory, both as regards convenience and economy of time, space and fuel. The most important improvement, however, claimed by Mr. Mahan is in the mode of casting the plates.

In the process of stereotyping, as ordinarily practised, the plaster moulds, taken from the movable type, having been well dried, are placed face downwards upon a cast iron plate, termed the "floater;" this is placed at the bottom of a cast iron tray or "dipping pan," having flaring sides and a lid, which is secured by a screw and clamp; this lid leaves openings at the corners of the tray. The dipping pan having been thoroughly heated before the moulds and floater are put into it, is then immersed in a bath of melted metal, which, entering at the corners of the tray, floats up the floater and moulds. The pan is then taken out, and put upon a water cistern, in such manner as to allow the liquid just to touch the bottom. As the metal shrinks in cooling, more is poured in, and when the whole is cool, the lid is removed, the mass taken out and the metal cast, separated from the plaster and superfluous metal by a mallet, when they are ready for finishing.

In Mr. Mahan's process a caster is employed. This caster consists essentially of an oblong cast iron box, made in four pieces, two ends and two sides, which are ground to fit accurately together, and fastened by screws and bands. It is divided into two equal portions by a transverse vertical partition, pierced near its lower extremity by two small holes.

The plates are arranged vertically in this caster, with the face of one to the back of the other. The caster having been properly heated, the metal is poured in, passing through the holes in the lower part of the central partition, rising on either side, and may be made to flow out of a hole in the end near the top of the plate of the caster, until all moisture and air are removed. The whole apparatus is then placed in a vessel containing water, which reaches a few inches up the inside. When cool, the caster is taken to pieces and the casts separated as in the ordinary process.

The advantages of the improvement may be stated to be—

1st, There being no necessity for immersing the casts and caster in the melted metal, no more metal need be fused and kept so than is necessary to fill the apparatus; thus effecting a considerable saving in fuel and avoiding loss by oxidation.

In one of the experiments witnessed by the Committee, 12 8vo. pages, containing each 4224 ems. in all 50,668 ems, were cast at one operation. The amount of metal in fusion was 50 pounds, and the weight of the plates when separated and dressed was 21 pounds.

2d, From the vertical position of the plates, a large number may be cast at one operation. In the ordinary process two pages 8vo are cast at one dip, and a good workman will make five of these dips in the course of an hour. By the method of vertical casting, the number of pages made at one cast may be readily increased to twenty or more. While the apparatus necessarily requires, from the amount of metal in it, a longer time to cool than the ordinary dipping pan, it is easy, by having several casters, to be filling a second or third while the first is becoming cooled. In this way the number of plates cast in a given time may be greatly increased, while the labor of dipping, removing, and cooling the pan for each successive pair is avoided.

The vertical position of the plaster moulds allows them to be made thinner, thus causing them to dry more rapidly, and enabling the operator to insert a larger number in a caster of given size.

3d, From the weight of metal above the plates and its gradual cooling from below, it has an opportunity of settling into all the hollows in the mass, by which cavities or *blows* are avoided.

4th, As the metal is made to flow through the apparatus, all air and moisture are expelled.

5th, From the simplicity, cheapness, and compactness of the whole arrangement, stereotyping may be performed with a little practice by the printers themselves.

The Committee is aware that attempts have been previously made to cast stereotype plates in the vertical position, but these have been abandoned on account of the difficulty of getting rid of the air and moisture. These difficulties appear to have been removed by the apparatus of Mr. Mahan.

The Committee has on several occasions witnessed the operation of casting by the inventor, and believes the process to possess the advantages claimed for it by him. It has examined the plates carefully; the face appears to be fully equal to that produced by the ordinary process; the texture of the plates on fracture is uniform, showing that no separation of the constituents of the alloy had taken place, and, in the specimens examined by planing, no *blows* were detected. Believing, therefore, that Mr. Mahan has achieved a valuable improvement in an important art, the Committee recommends the award of a first premium for the apparatus on deposit at the last Annual Exhibition, as well as that of a Scott Legacy Medal and Premium for the invention.

By order of the Committee.

Wm. Hamilton, *Actuary.*

Philadelphia, January 12th, 1854.

Description by the Inventor.

Fig. 1, is an elevated view of the caster.

Fig. 2, is a sectional view of the same.

Fig. 3, is a perspective view of a thin plate of iron having projecting sides and bottom.

Fig. 4, is a semicircular plate of iron, used to prevent the moulds from floating.

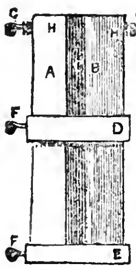


Fig. 1.

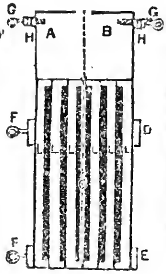


Fig. 2.

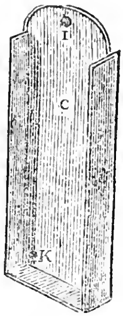


Fig. 3.


Fig. 4.

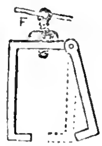


Fig. 5.

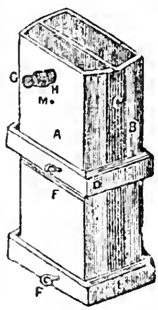


Fig. 6.

Fig. 5, is a band and screw, used to fasten the caster together.

Fig. 6, is a perspective view of the caster when in readiness for operation.

A, in figs. 1 and 2, is one side of the caster as shown by A in fig. 6.

B, in figs. 1 and 2, is the other side of the caster as shown by B in fig. 6.

C, in figs, 1 and 2, is placed between A and B, in the bottom of which are two or more holes, as shown by K in fig. 3; D and E are bands to fasten the caster firmly, having a joint at one corner, for the purpose of removing it with facility, as shown by fig. 5.

F, in figs. 1 and 2, are screws to fasten the bands, as shown by F in fig. 5.

G, in figs. 1 and 2, are two screws, used to fasten down the moulds by screwing against two semicircular plates of iron, as represented by fig. 4.

L, L, L, L, L, L, in fig. 2, are moulds, showing the position they are placed in the caster.

M, in fig. 6, is a hole to let off metal when necessary.

Fig. 7, is a perspective view of the melting pot.

Fig. 8, is a sectional view of the melting pot, and replenishing funnel.

Fig. 9, is a sectional view of the furnace melting pot, replenishing funnel, floater, and drying oven.

Fig. 10, is an elevated view of the furnace when complete.

Fig. 11. is a view of melting pan, cooling vessels, and caster, showing the position in which they are placed when drawing off the metal.

A and A, in fig. 7, are two rods used for drawing off the metal into the caster, as shown by figs. 8, 10, and 11.

B, is the replenishing funnel, having a lid attached, which answers as a covering for a part of the furnace and a tube, through which the metal passes into the melting pot, as shown, by figs. 9, 10, and 11.

c, is a lid which completes the covering of the furnace, as shown by fig. 10.

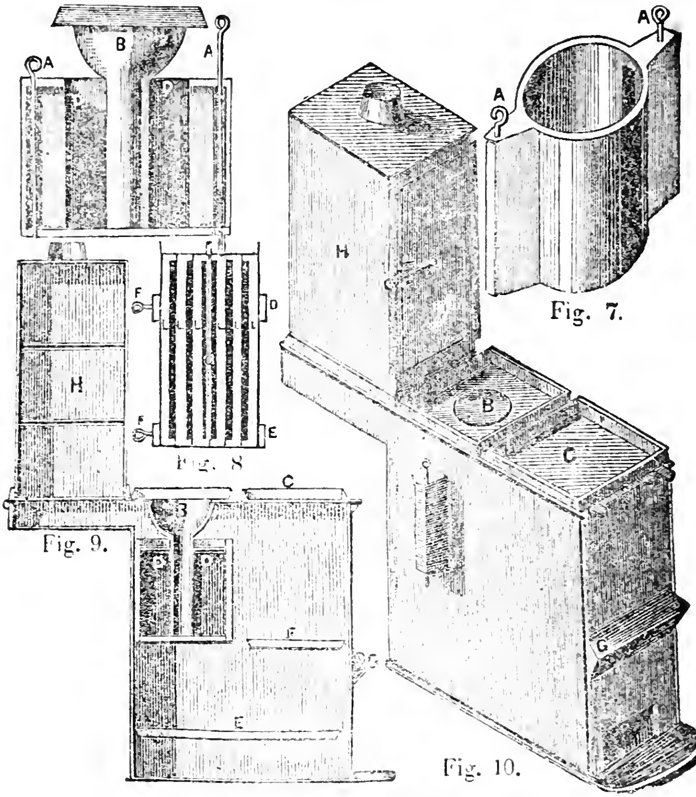


Fig. 9. Fig. 8. Fig. 10. Fig. 7.

D, in fig. 8, is a plate of iron floating on the surface of the metal; this excludes the atmosphere and prevents its oxidization.

From the position of the caster in figs. 8 and 11 it will be seen that the metal is drawn into the side B of the caster, flows through the holes K, and passes off at the hole M if necessary. This however is not necessary when the moulds are perfectly dry, but in case they are not, which may be known by their bubbling, it is necessary to let the metal off at M until the bubbling ceases; it now only remains necessary to cool off by pouring water into the cooling vessel to the depth of about one inch. The cooling commences at the bottom, leaving the upper part longer fluid, which gradually settles down, and fills all the vacua which would otherwise take place.

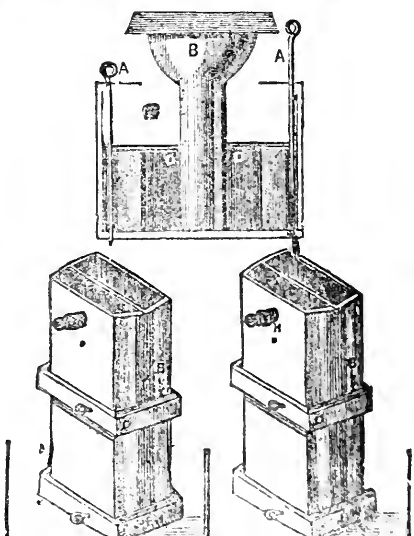


Fig. 11.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MARCH, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America. By John C. Trautwine, Civ. Eng., Philad.

To the Committee on Publications.

Gentlemen—I avail myself of your Journal, to communicate a few leading facts respecting the proposed Inter-oceanic Canal Route, by way of the Rivers Atrato and San Juan, in New Granada. They were elicited during a hasty exploration of that route, made by myself, in the year 1852, under the auspices of a few enterprising gentlemen in the city of New York, represented by Messrs. Belknap and James.

Desirous to test the feasibility of the project, in a commercial point of view, these gentlemen contributed the necessary funds, on a liberal scale; and desired me to undertake the task.

The purely financial motives which dictated the survey; combined with the necessity for expediting it as much as possible, preventing me from devoting any attention whatever to objects of scientific inquiry not having immediate reference to the principal question. This was, the availability of the route for steamers of about six feet draft, from ocean to ocean.

Further than this, I was left unimpeded by instructions; and at liberty to adopt such a course of proceeding as I might deem most expedient.

Since my return, professional engagements have prevented me from drawing up such an account of my observations as I should wish to make public; and my only apology for now presenting the following

crude and immethodical statement of some of the more prominent features of the route, is the hope that I may thereby obviate the necessity of replying to the numerous communications on the subject which I am constantly receiving from persons who have incidentally become apprized of my trip.

It would afford me sincere pleasure to prepare a full and detailed narrative of my operations, embracing the numerous objects of interest that presented themselves during the exploration; but more imperative duties prevent my doing so at present.

I at first determined to take with me but one person, Mr. Henry McCann, to act in the capacity of purveyor; that my own time and attention might be exclusively devoted to the more important objects of my mission. Subsequently, however, I added Dr. Mina B. Halsted, a young physician of New York, possessed of scientific attainments beyond the mere requirements of his profession. Impelled by a desire to investigate the botanical treasures of the valley of the Atrato, the Doctor expressed a wish to accompany me, if but as an amateur traveler, defraying his own expenses. To the first part of his proposition I assented; but could not accede to the last.

He assisted me very efficiently in many of my operations. His botanical researches were, necessarily, imperfect, as I did not feel at liberty to prolong the exploration for considerations of secondary importance, however interesting they might be in themselves. His results would have been incorporated in a full narrative of the expedition, had I had leisure to prepare one; but, as such is not the case, I hope they may be made known through some other medium.

Passing over further preliminaries, we will at once commence with the mouths of the River Atrato. The accompanying map, Plate I., of these mouths, which is prepared from my own observations, differs materially in many points from the best Spanish authorities that I could obtain. I presume, however, that the discrepancies are more justly ascribable to actual changes, which have taken place in the interval that has elapsed between the two sets of observations, than to error on the part of the observers. This supposition is rendered the more probable from the fact that I found the map to be comparatively correct from the mouths to the very head of the river, a distance of nearly three hundred miles.

I will premise, that my estimate of distances, along the streams, was based upon frequently repeated observations of the rate at which our boat was poled along; and that, consequently, although not strictly correct, they may, at least, be assumed as very tolerable approximations to the truth. Allowing the utmost latitude for error, I am confident that they are generally within ten per cent. of the actual distances.

The several branches by which the river discharges itself into the Gulf of Urabá or Darien, are called caños, pronounced cán-yös. The mouths themselves, or points at which these caños enter the gulf, are called bó-cas, (Spanish for mouths.)

It will be seen from the map, that all the mouths of the Atrato (nine in number) have their courses through an extensive region of swamp.

At the immediate banks of the streams, the swamps are elevated a few inches above the water-surface, in its ordinary stages; but at the distance

of a few rods back, they are about level with it; consequently, when the caños are swelled a foot or two, by either a rise of the river above, or by the action of the North winds in forcing the salt water of the gulf inland, this broad expanse of marsh becomes inundated; presenting the appearance of an immense lake, studded with trees.

The soil is composed of a black mud, and very fine sand, which supports a vegetation of undergrowth and trees; generally dense near the water's edge, but more sparse at some distance back from it. I observed that none of the trees attained more than a very moderate size. This is, probably, attributable, in part, to the effect of the salt and fresh water, in which their roots are alternately submerged; for, above the point to which the salt water of the gulf is sometimes driven, the trees are larger. Still, I do not remember to have seen a single really large tree growing throughout the entire course of the Atrato.

The North winds sometimes back the salt water of the Gulf of Urabá more than twenty miles up the river, or to some distance above its confluence with caño Urabá.

It is evident that the attempt to locate a town, or settlement of any kind, throughout this extent (or, as will be seen hereafter, for a great distance above it,) would be attended with excessive labor and expense. Buildings would necessarily have to be elevated several feet above the surface of the soft marsh; the construction of streets and roads would be extremely difficult; and, together with the maintenance of a supply of fresh water, could be effected only by the expenditure of very large sums.

The formation of these immense swamps has been the result of depositions of mud, sand, trees, &c., which, for ages, have been accumulating and encroaching upon the waters of the Gulf of Urabá. These depositions are brought down from the upper country by the river itself, in times of flood; and the process is still in active operation. It is quite apparent that the entire bed of the river, from near its very source, has been formed in this manner; as it is confined throughout, between natural levees, backed by wide tracts of swamp land, considerably lower than the tops of the levees; and annually overflowed by the floods of the river, which overtop the levees themselves to a height of some few feet.

The current through the Bocas, being checked on encountering the waters of the gulf, allows the mud and sand to subside, and thus form bars outside. Upon these bars floating trees and logs are lodged and retained, and by constant accumulation soon reach the surface, when vegetation commences and progresses with great rapidity.

By this process the mouths gradually advance themselves out into the gulf, through banks of their own creation. The accompanying sketch, Plate II., of the entrance into Boca Coquito will convey a tolerable idea of this operation of nature.

Bars of sand and mud encircle all that part of the gulf coast within which the mouths of the river are comprised; and may be regarded as extending some way up into the caños themselves, because the latter deepen considerably as we advance a short distance (rarely exceeding a few hundred yards) above their actual mouths, or points of effluence into the gulf.

These bars, especially in front of the Bocas most exposed to the

North, are subject to great and sudden changes, depending on the alternate ascendancy of one or the other of two antagonistic forces which are constantly acting upon them. From December to March, (both inclusive,) during which interval the North and North-east winds from seaward prevail, and at such times as the river is not much swelled by heavy rains in the interior, the bars with a Northern exposure accumulate rapidly, *by the heaping up of sand from the gulf*, until they become nearly dry.

Those mouths which are comparatively sheltered from the effects of the Northers, and from the swell of the sea, are of course less liable to the heaping up of bars of sand from the gulf; and, consequently, their obstructions, although consisting of softer material, (mud and fine sand, brought down *by the river*, instead of the course sand *of the gulf* bottom,) maintain a somewhat more permanent regimen; and would, consequently, be more readily susceptible of artificial improvement.

When the more exposed mouths become thus obstructed, they preclude, for a time, the entrance of vessels drawing more than about three feet; and even that limited depth is frequently confined within a very restricted channel width, and obtainable only at high water.

But when, on the other hand, the river, in a high stage, is discharging a great volume of water through the Bocas; and when, at the same time, the seaward winds are comparatively quiet, (or succeeded by the milder Southers and irregular winds, which blow gently from April to November,) the action of the streams partially wears down the bars, and transports back again the sand of which they were composed to a considerable distance out into the gulf.

At such times, channels of some hundreds of feet in width, and from one to two fathoms in depth, are opened across the bars, affording free ingress to vessels of moderate draft. When I visited Boca Tarena, about the middle of June, the sand-bar in front of it was *entirely dry* in many places, at a distance of a mile out into the gulf. This mouth is more exposed than any of the others, to the bar-forming agency of the Northers.

At Bocas Candelária and Páva, I found but two feet of water at one-fourth of a mile from shore; and opposite Boca Matuntúbo, through which Caño Barbacoas discharges itself into the gulf, there were but three feet for a width of one-fourth of a mile, parallel to the shore; and distant from it, from a half to three-quarters of a mile.

In all these cases, however, the depth increases rapidly on the seaward side, after crossing the bars. The little steamer *Esmeralda*, bound up the Atrato, on a gold-hunting expedition, crossed the bar of Matuntúbo a few months after I examined it; and I was informed that she found a channel depth of nine feet where I had found but three.

And several years ago, a British steamer, with diving machinery for under-water gold explorations, and drawing (I was credibly informed) eight feet, crossed the bars without any trouble, and ascended the river for about 250 miles. The boat in which I ascended, and which is one of the largest that trade between Carthagena and Quibdó, drew but three and a half feet; and grounded at the mouth of Caño Coqúito; so that we were compelled to wait for high water before we could enter.

I had no opportunity for ascertaining the existence of oceanic currents along this part of the coast; and, consequently, can advance no opinion as to what extent the alternate formation and destruction of these bars may be effected by their agency. I know, however, that if such currents do exist, their velocity is very slight; and can perform but a secondary part in the process which interposes so formidable a barrier to the navigation of the noble Atrato.

Thus, it is evident, that *in the present condition of these bars*, no scheme of navigation by steamers, or vessels of greater draft than the river boats now in use, could be carried into effect, in case *regularity* of transit constituted an essential element of success to the project.

I have arranged, in the following table, the soundings across the several bars, immediately in front of the Bocas, as I found them in June, 1852; commencing with the most Northerly one; or Tarena, and tàking the others in regular succession :—

Soundings in feet at low water.

Names of Mouths.	A short distance inside of the mouth.	In the mouth.	One hundred yards out.	Two hundred yards out.	Three hundred yds. out.	One-fourth of a mile out.	Half of a mile out.	Three-fourths of a mile out.	One mile out.	One and one-fourth of a mile out.
Taréna, . .	25	16	13	12	12	10	7	6	2	70
Candelaria, .	12	8	3	3	3	4	70	—	—	—
Páva, . .	18	8	3	3	3	4	21	70	—	—
Matuntúbo, .	18	13	10	8	9	6	3	3	18	70
Coqúito, . .	12	9	2	2	2	4	6	10	72	—
Coco Grandé, .	22	12	3	3	3	4	32	—	—	—
Pantano, . .	18	11	About the same as opposite Coco Grandé.							
Urabá, . .	22	12								
Piquindé, . .	—	—								

Bocas Taréna and Matuntúbo discharge much greater volumes of water than any of the others; consequently, the balance of power between their streams, and the waters of the gulf, takes place at greater distances from the shore; making the most dangerous parts of their bars at about a mile outside of their entrance into the sea.

Any attempt to improve either of these mouths, (or that of Páva, or Candelaria,) so as to be, at all times, available for vessels of but six feet draft, would not only be attended with great expense; but would, in my opinion, involve the utmost hazard of failure. I have no hesitation in admitting that I am unacquainted with any scheme that can be confidently recommended for the permanent accomplishment of that purpose; and shall, therefore, not occupy time in discussing the various expedients that might be supposed applicable. All attempts of the kind, under similar circumstances, have proved signal failures; and the resources of engineering science afford no aid in cases of such magnitude as would be involved in this instance.

The other, and smaller mouths lying further inside the Gulf of Urabá, are also subject, though in a less degree, to the same class of impedi-

ments. The one which I regard as most susceptible of improvement of a somewhat permanent character, at a moderate expense, and on a small scale, (say, for instance, one that would secure a depth sufficient for vessels of six or eight feet draft,) is that of Coqúito.

In its present condition, this mouth and its accompanying caño are the most insignificant of them all, except Pántano, and Piquindé. It will be seen, in Plate I., however, that the mouth is partially sheltered from the disturbing effects of North and North-east winds, by the Isla de los Muértos, or Island of the Dead.

This island is about three-fourths of a mile in length; low and flat. It has evidently been formed by the accumulation of mud and vegetable matter deposited by the adjacent caños; and will probably soon be united with the shore by the same process, as the depth of the intermediate water does not now average two feet at low tide. The low water depth opposite caño Coqúito, and close to it, is scarcely two feet; but gradually increases to six feet, at the distance of half a mile out into the gulf. In a quarter of a mile more, the depth becomes ten feet, and immediately afterwards forty feet; increasing to seventy feet at a distance of a mile from shore.

The bottom consists of mud and very fine sand; so soft that a pointed pole can readily be pushed into it for six or eight feet. I suspect, that by confining the channel from the mouth outwards, (to such a distance as would reach the required depth of water,) so as to prevent its spreading over a wide surface as it issues from the caño, the force of the ordinary gentle current, aided by the more rapid ones of flood stages of the river, would, of itself, deepen a channel sufficient to allow, at all times, the passage of such boats as could regularly ascend the Atrato to Quibdó, a distance of about 220 miles.

At all events, this could readily be effected by the aid of a dredging machine.

As to the mode of confining the channel, I would follow the example set by nature herself, in constructing similar works at the same spot; encouraging the deposit of sediment for the banks by placing two rows of poles, water-soaked logs, branches, &c., to form the nucleus for receiving and retaining it. The process should be expedited by throwing upon these, some of the mud of the intermediate space. This deposit would immediately become covered with vegetation, by which its durability would be secured. It is by a process precisely analogous to this, that the river has, and still is, rapidly extending the banks of its various caños into the gulf. From the fact that the depth increases so immediately, from six, to forty feet, and from that to seventy feet, I conceive that a long time would elapse before the accumulation of sediment at the outer extremity of this artificial channel would be productive of inconvenience.

A similar method might, I think, be successfully employed at Boca Urabá; but, for the reason before expressed, I should prefer Coqúito. The latter is the passage almost invariably selected by the river boats.

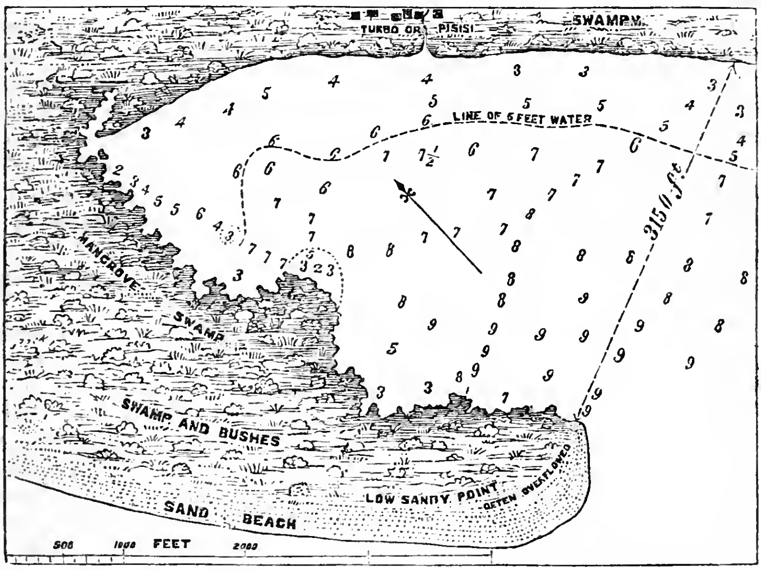
I nowhere found the currents through the caños to equal a mile per hour; and doubt whether, even in floods, they reach two miles per hour; in consequence of the facility which the lowness of the adjacent region affords for the spreading of their waters.

The Atrato, when in flood, throws a current entirely across the gulf, to its Eastern shore. I frequently drank the water dipped up opposite some of the larger mouths, at the distance of a full quarter of a mile from them, without perceiving the slightest saline taste.

The Bay of Candelária is referred to in books of navigation, as affording a safe harbor; but I confess myself at a loss to perceive upon what principle it can be assumed to do so, except that of the rare occurrence of violent Northerly winds, that should endanger the safety of craft anchored in it.

That such winds occur in that region only at rare intervals, is unquestionably true; and this fact constitutes a redeeming feature in more harbors than one, on this, and the adjacent coasts, that would otherwise be highly objectionable. I may cite, for instance, that of Navy Bay, at the Atlantic terminus of the Panama Railroad, which relies entirely upon this hazardous dependance for its character as a place of refuge. I regard the lower, or more Southerly portion of the gulf, as altogether preferable to the Bay of Candelaria, in the event of actual stress of weather.

HARBOR OF TURBO OR PISISI.



Rise and fall of tide about 18 inches. Soundings in feet, at low water. Bottom, mud and fine sand.

The town of Túrbo, Plate III., on the Eastern shore of the gulf, opposite Boca Coqúito, is merely a collection of about a dozen huts. There is no other town in the vicinity of the gulf. Having, while in Carthagena, heard some importance attached to the Harbor of Túrbo, I had hoped to find it, at least, an efficient shelter for coasters, and such steamers as it might be thought advisable to place on the Atrato. Upon making a survey of it, however, I found that its merits had been entirely overrated, as will be apparent upon referring to the annexed cut. It is gradually shoaling, by the inwashing of land mud by rains; and I was told that a marked deterioration has been from time to time observed.

The larger published maps of the Gulf of Urabá would lead to the supposition that some rivers of considerable magnitude enter it along its Eastern and North-eastern coasts. Such, however, is not the case. The streams laid down as rivers, are merely extensive *washes*, penetrating some miles into the interior, and serving as drains during the rainy season. In dry periods, most of them become nearly destitute of water; and many of them entirely so; and their mouths are then completely closed by the heaping up of sand from the bottom of the gulf by the action of the Northers. I was informed that the River Túrbo was by far the most constant and important of them all; and even it, is but an insignificant stream, barely adapted to small canoes, when its mouth is not closed by sand. Were Túrbo itself a place of any magnitude, its probable dependence for water would be from this river; but at present, the limited demand is met by a scanty and precarious supply obtained from the immediate vicinity of the town, (if such it may be called.)

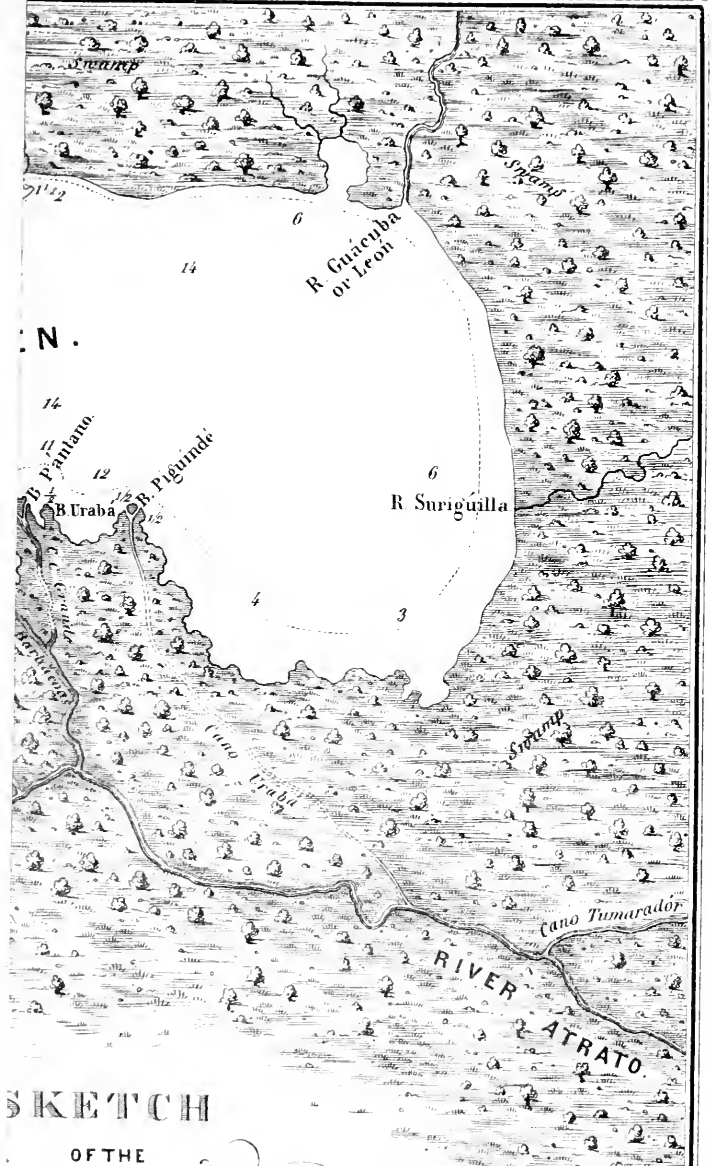
I had not time to visit the mouth of the River Guácuba, or Lion, at the Southern extremity of the gulf; but was informed, in vague terms, by persons in Túrbo, who had repeatedly ascended it in canoes, that it was a large river; extending a great distance into the interior, where it branched out into numerous tributaries, extending to gold regions near the Eastern slope the Cordilleras.

The gulf abounds in fine fish, of many species, and large size, entirely new to me. Large turtles, of both the common, and the tortoise shell varieties, are found on the adjacent coasts. Sharks also abound.

The india rubber tree grows here, although not very abundantly; and a factory for preparing the rubber from the milk of the tree is established at Túrbo, by a New York house. Its appointments, however, are on a very limited and primitive scale, adapted, I presume, to the moderate supply of the raw material.

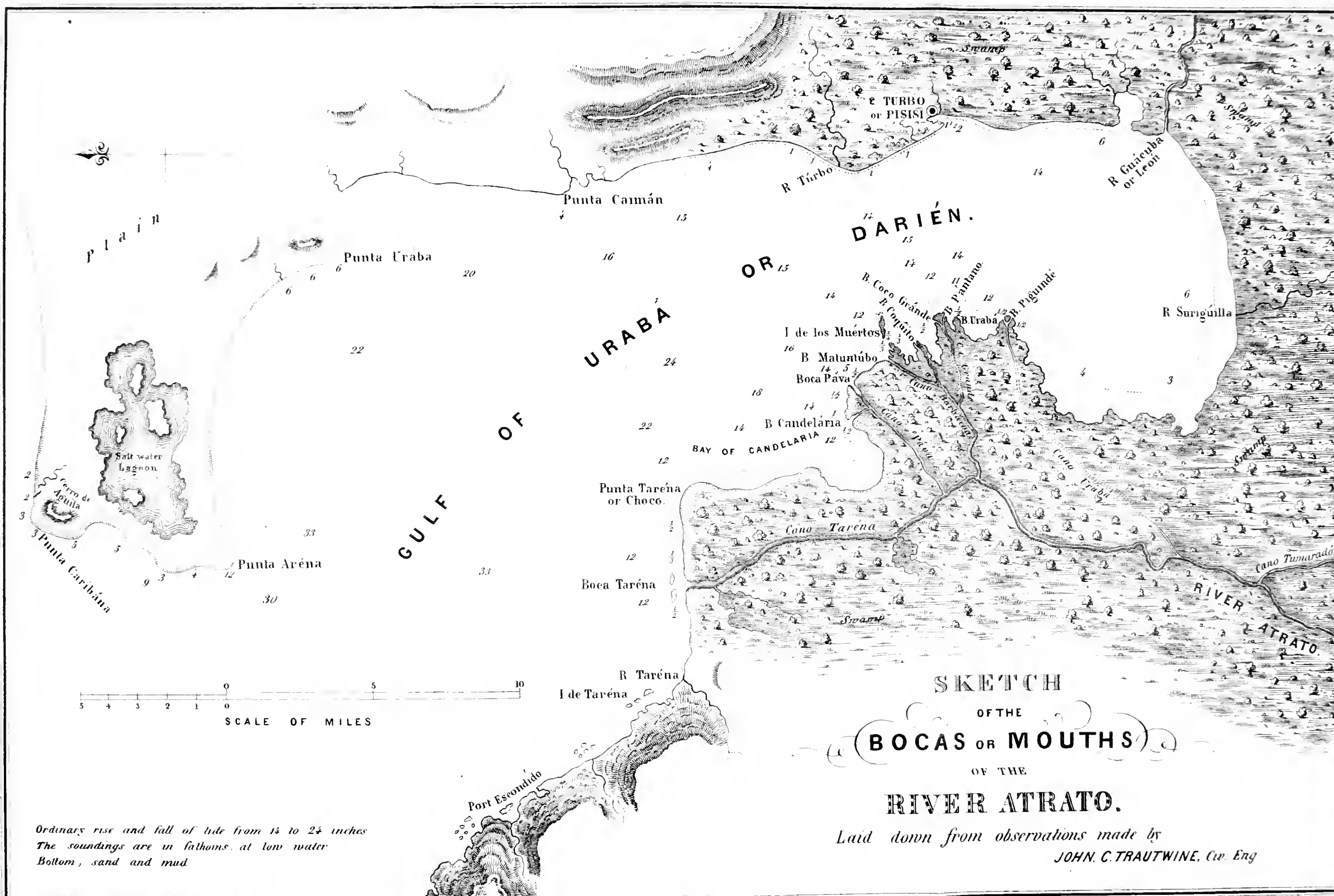
A small tribe of Indians, called Caimánes, (alligators,) are the sole occupants of the territory between Túrbo and Punto Aréna. They construct their rude dwellings a little back from the gulf, so as to be out of sight. For what purpose this is done, I could not ascertain. Some three or four of their men came on board of our little vessel, as we lay at anchor near the shore, after rounding Punto Aréna. They were of short stature, good natured, and inoffensive in appearance and conduct; and fully sensible of the merits of segars, and brandy and water. They wore their long hair confined close to their heads by rude combs of their own manufacture; made of fish bones, tied separately to a transverse piece of stick. Their dress, though very coarse, was scrupulously clean, and consisted of shirt, trousers and roundabout. Unlike the other Indians with whom we afterwards met; they did not speak Spanish, so that our conversation was conducted on the pantomimic principle.

About the Gulf of Uraba, rains fall chiefly during the eight months from April to November, both inclusive. They are not, however, by any means excessive, even during this period; but occur chiefly in the shape of short smart showers, of from a few minutes, to some hours duration, especially during the night; with occasional heavy and prolonged falls of one or two days. It is even by no means uncommon for intervals of from three to six days to elapse, during this wet season, without



SKETCH
OF THE
AS OR MOUTHS
OF THE
ER ATRATO.
from observations made by
JOHN. C. TRAUTWINE, Civ. Eng.

Lith of P S Duval & Co Philad.a



Lith of P S Duval & Co Phila

a drop of rain. Of the ten days of June (from the 5th to the 14th) that I remained at the gulf, it rained, more or less, on seven. With the exception, however, of a single heavy fall for four hours one afternoon, the rains that occurred during *the day* were commonly mere trifling sprinklings, that did not interfere with my surveying operations; but, on three of the *nights*, the rains were copious and of some hours duration; accompanied by a good deal of thunder and lightning. Subsequent experience of some months, along the vallies of the Atrato and San Juan, proved that by far the greater portion of the rain of that region falls during the night.

The following table presents the readings of my aneroid barometer, which was suspended in the shade, in the doorway to our little cabin, (or, rather, oven,) at the height of three feet above the level of the sea:—

Time of day.	JUNE.									
	5th.	6th.	7th.	8th.	9th.	10th.	11th.	12th.	13th.	14th.
A.M.										
4½	. .	. .	. .	. .	. .	. .	. .	29·895	. .	. .
5	. .	. .	29·912	. .	. .	. .	. .	. .	. .	. .
½	. .	. .	. .	. .	. .	. .	29·892	. .	. .	. .
6	. .	29·948	. .	. .	29·925	29·920	·895	·920	29·940	29·910
½	. .	. .	. .	29·930	. .	. .	. .	. .	. .	. .
7	29·975	. .	·948	·950	·950	·925	·897	·925	·950	·925
½	. .	·985	. .	. .	. .	. .	. .	. .	. .	. .
8	·987	30·010	. .	. .	·951	. .	·925	·940	·975	·940
½	. .	. .	. .	. .	. .	. .	·930	. .	. .	. .
9	30·012	. .	30·000	·973	. .	·915	·945	·965	·980	·962
10	30·018	30·025	30·000	·965	·972	. .	. .	·940	·978	·975
11	. .	30·000	. .	. .	. .	. .	·930	. .	·960	·970
12	30·000	29·980	29·950	·950	·920	. .	·925	. .	·950	·970
P.M.										
1	29·992	. .	. .	. .	·895	. .	·900	. .	·940	·930
2	. .	.950	. .	. .	·900	. .	·875	·925	·925	·900
½	·940	. .	. .	. .	. .	. .	. .	. .	. .	. .
3	. .	·912	29·876	. .	·850	. .	·860	·900	·900	. .
½	. .	. .	. .	. .	. .	. .	. .	. .	. .	·860
4	·935	·908	·872	. .	·875	. .	·860	·915	·880	·860
½	. .	. .	. .	. .	. .	·895	. .	. .	. .	. .
5	·925	. .	. .	. .	·868	. .	·875	·920	. .	·850
½	. .	. .	. .	. .	. .	·850	. .	. .	·880	. .
6	·937	.925	. .	·890	·895	·850	·900	·925	. .	·850
7	·945	. .	·900	·900	.895	. .	. .	·920	·875	. .
½	. .	. .	. .	. .	. .	·875	·890	. .	. .	·850
8	·942	. .	·915	. .	·925	·878	. .	·925	·880	. .
9	. .	. .	·927	. .	·975	·875	. .	·930	·925	·870
½	·962	. .	. .	. .	. .	. .	·900	. .	. .	. .
10	. .	. .	. .	. .	. .	. .	. .	. .	. .	·895
½	. .	. .	. .	. .	. .	. .	. .	. .	. .	·900

The thermometer, in the same position, generally ranged between 80° and 82° of Fah., at sunrise; 85° and 93° at noon; 86° and 95° at 3, P.M.; 84° and 90° at sunset.

The Veranillo de San Juan, or short summer of St. John, is a comparatively prolonged spell of dry weather, that annually interrupts this

rainy season of eight months. It generally commences in August, and extends through the greater part of that month. Its periods, however, are subject to a considerable irregularity, as it sometimes begins in July; and sometimes, though rarely, even in June, and is prolonged through July into August. In other years, again, its entire duration is limited to but two or three weeks.

During my stay, the winds were light, and blew alternately from every point of the compass; affording no indications of either regularity of recurrence; or of a prevailing direction. The only birds I saw about the gulf, were two or three spoonbills, and a few cranes. Along the beach, near the mouth of Barbacoas, we picked up some small fragments of gum animé.

In my next communication, I will refer to the caños, and to the River Atrato itself; together with the lower portions of the Napipi, and one or two other tributaries which I ascended, and sounded, for a few miles.

(To be continued.)

Report of the Board of Managers of the Mine Hill and Schuylkill Haven Railroad Company, at their Annual Meeting, January 9, 1854.

The Board of Managers have the pleasure to lay before the Stockholders of the Mine Hill and Schuylkill Haven Rail Road Company, their Twenty-Fifth Annual Report.

In amount of coal transportation, the business of the road for the year just closed has not quite equalled the expectations of the Board at its commencement, having fallen below that of the previous year about eight-tenths of one per cent.

Similar retrocessions of much greater proportional magnitude have occurred several times in the brief history of the anthracite trade. For example, the business of the road in the year 1834, was forty-four per cent. less than in 1833; also in 1838 it fell off sixteen per cent., and in 1842, fourteen per cent. from the business of the year preceding.

From 1842, it steadily increased at an average rate of about 70,000 tons a year until 1848, when a temporary pause ensued for almost two years, in which the average growth was only 20,000 tons. In the next succeeding biennial term, the advance was beyond all precedent, reaching almost 200,000 tons each year, or nearly sixty-six per cent. increase in the space of two years, and presenting an example of one of those great waves of progress which, in accordance with the common law of growth, whether in nature or in trade, must be followed by a temporary reaction.

By the weekly returns from the Collector's books, the gross tonnage of coal is shown to be one million forty-nine thousand four hundred and sixty-one (1,049,461) tons, and the amount of other merchandise, nineteen thousand seven hundred and forty-five tons, two cwt. ($19{,}745\frac{2}{20}$). Making together, after deducing five per cent. allowed to the dealers for wastage, an aggregate net tonnage of one million sixteen thousand seven hundred and thirty-three tons, one cwt. ($1{,}016{,}733\frac{1}{20}$).

There has been charged for tolls and use of motive power on this traffic, the sum of two hundred and fifty-eight thousand three hundred and fifty-nine dollars, thirty-eight cents ($258,359·38), and for passengers, two thousand two hundred and eighty-nine dollars, twenty-one cents. The entire revenue being two hundred and sixty thousand six hundred and forty-eight dollars, fifty-nine cents ($260,648·59). It will be observed that while the amount of tonnage is diminished, and the charge for motive power on the laterals of high grade has also been reduced, there is an increase of revenue amounting to three thousand nine hundred and seven dollars, seventy-five cents. This arises from the augmentation of miscellaneous tonnage, and from the opening of collieries at more distant points of the road; and from present indications there is reason to expect a much greater increase of income from the same causes in future.

Of the several extensions and improvements of the road reported as in hand at the time of the last annual meeting, some have been finished and brought into successful operation, and others have advanced toward completion as far as circumstances have allowed. Upon the extension over Broad Mountain, the work has been retarded by the difficulty, amounting during the spring and summer almost to an impossibility, of obtaining and keeping upon it a sufficient force of laborers and mechanics. As the contractors for the work found it to be impossible to complete their several sections in the stipulated time, even by giving an advance of wages that would entail a heavy loss, it was deemed right to grant such an extension of time as would enable them to wait for the increased supply of laboring hands expected in the course of the autumn and winter. This anticipation had now been fully realized, and the contractors are required to make such additions to their forces as will secure the completion of the grading and bridging, early in the coming spring.

On several miles of the line upon which the grading is finished, the laying of the track has been commenced, and it will be continued on these, and other portions now nearly ready, as fast as the iron is delivered by the manufacturers.

The engines and other machinery for the inclined planes, are in a state of forwardness that will enable them to be erected as soon as the masonry of the foundations is completed, and the latter work is now in hand by skilful and energetic contractors.

In the great coal field which this extension of our road is designed to reach, preparations for mining are actively progressing at several points contiguous to the main line of the road, on a scale of magnitude that affords promise of a large trade immediately on the opening of the road: in addition to which there are numerous openings on large coal seams at points to be reached by short lateral branches that may justify the anticipation of its future increase to any extent the market shall require.

Besides this most important extension, there are several other works of construction that have engaged the attention of the Board, which may be esteemed worthy of mention.

The lateral to Middle Creek, commenced in 1852, was completed early in the last summer; but owing to the difficulties frequently incident to new undertakings, and other causes, the large colliery to which it leads was not brought into successful operation until near the end of the

year; it is, however, reported to be now in a state of completeness and efficiency, that will furnish a tonnage quite equal to the large expectations which led to the construction of the road.

A section of the main line of old road, about one mile long, passing through the gap of Second Mountain, has been re-located in accordance with the general system of improvements described in former reports; and in furtherance of the same system, another section of considerably greater length, extending from the present head of the main road to a point below Minersville, is now being graded on a re-located line which has the great advantage of lying entirely out of the town of Minersville, and also reduces very considerably the heavy grade at Mine Hill Gap.

By the completion of the new engine depot at West Haven, the use of the old depot has been obtained for the purposes of general storage, and for an enlargement of the repair shop; giving sufficient room in the latter for the introduction of additional machinery that was much needed for the proper execution of repairs of engines.

The new freight engines of heavy class with eight connected driving wheels, ordered last winter from the manufactory of Mr. Baldwin, were received from him in due season, and have been found on trial to be more perfectly adapted to the haulage of heavy trains on steep gradients, than any before in use. They not only possess much greater tractive power, but also have greater flexibility on curves, and in consequence of the careful equalization of the weight on the drivers, they produce less maximum pressure on the rails at any single point, than other engines of smaller effective power.

They are believed to be the first ever built with these peculiar excellencies so completely developed, and may therefore be esteemed as models on which it will be advisable to construct the engines that may by required in future for the business of heavy haulage.

The Board has much satisfaction in being able to announce that arrangements have been made, under authority of an Act of Assembly conferring the requisite powers, whereby the coal tonnage of the extensive basin lying west of Tremont will be brought upon our road, on its best route to northern and eastern ports.

This arrangement, which is of a character highly advantageous to all the parties interested, will secure to us a connexion with a mineral field of great importance heretofore inaccessible to any eastern market, and will also make available in due time a line of communication between the Schuylkill coal region and the lower Susquehanna more direct than any other now known.

From the report of the Engineer and Superintendent of the road, Mr. R. A. Wilder, there appears to have been an amount of work done on re-locations of line, relaying old track, construction of new sidings and switches, and short laterals for facilitating the business of the operators at their mines, greater than in any former year.

The length of track laid, exclusive of that on the extension to Ashland, has been thirty-seven thousand one hundred and eighty feet, or a little over seven miles; distributed as follows: New laterals or extensions of laterals, twelve thousand seven hundred and seventy-two feet; new track at new depot, new scales and collector's office, together with a third

track at West Haven, four thousand two hundred and thirty-two feet; new sidings for operators, including over forty switches, six thousand seven hundred and twenty feet. Old track relaid, seven thousand eight hundred and fifty-six feet; on re-locations, five thousand six hundred feet. Of these several tracks, twenty-nine thousand eight hundred and twenty-four feet are laid with new rails weighing sixty pounds to the yard, and seven thousand thee hundred and fifty-six feet with old rails of various patterns. The engineer also makes a statement which it is highly gratifying to be able to record, to the effect that there has not been, during the year, a single instance of loss of life or limb by any passenger traveling over the road, nor any person in the Company's employ.

The tabular statements hereto appended, exhibit the treasurer's accounts showing the condition of the finances of the Company, and the usual statistics of the road and engines.

By order of the Board of Managers,

John C. Cresson, President.

Philadelphia, January 9th, 1854.

Note.—The cost of fuel used for the motive power on this road has been, for coal. wood, and sawing and piling ready for use, $9323·86, equal to 9 cents per mile run by engines, or 15 cents per ton of freight per mile.

AMERICAN PATENTS.

List of American Patents which issued from January 10th, 1854, to January 31st, 1854, (inclusive,) with Exemplifications by Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

JANUARY 10.

42. For an *Improvement in Oil Cups for Steam Engines;* David Clark, Philadelphia, Pennsylvania.

Claim.—"What I claim is, constructing the oil cup in the manner described, or in any other equivalent thereto, so that the flow of the oil from the chamber, into and from the chamber, may be regulated wholly by the agency of steam and gravity, as set forth."

43. For an *Improved Press for Veneering;* Lucian A. Brown and Jeremiah W. Brown, Hartford, Connecticut.

Claim.—"We do not claim the method or process of setting or pressing a veneer down on a surface, by the employment of the pressure of water exerted against a flexible material or caul, having the elasticity of vulcanized caoutchouc, nor the application of heat to such caul through such water; but we do claim the employment, in the manner set forth, of a thin metallic plate or caul, not only having the property of flexibility, but that of sufficient tenacity to take out curls, in manner and under circumstances above stated; and we also claim the combination of a flexible metallic caul, with a box having flexible sides. We also claim the combination of the water trough and flanch with the flexible sides, and frames of posts of the box, the same being made to operate substantially in manner and for the purpose as stated."

44. For an *Improvement in Cotton Gins;* Leonard Campbell, Columbus, Miss.

Claim.—"I do not claim the use of brushes suspended in a position so as to allow them to hang loosely between the ginning saws; but what I do claim is, the concave brush ribs and concave brush, in combination with the brush wheel, for the purpose of scouring the

nap (which is formed by the ginning saws) out of the cotton, and, at the same time, remove all impurities or foreign substances from it; said ribs are each of them provided with two rows of short stumpy bristles, which are secured on the inner edges of said ribs as described. 2d, I claim the concave plate for the purpose of regulating the current of air which passes between said plate and the wheel, substantially as described."

45. For an *Improvement in Preventing Dust from Entering Railroad Cars;* Daniel S. Darling, Brooklyn, New York.

Claim.—"What I claim is, arranging a series of deflectors along the side of the locomotive and entire train of cars, in such a manner that a series of funnel-shaped chambers will be formed, which run into each other and form a continuous channel for the dust and air under the car to be confined in, while the funnel-shaped mouths, at the front of the locomotive, receive a powerful outside pressure of air, which, by the position of the deflectors, is forced into less than its ordinary space, and causes an extraordinary suction current under the train, which concentrates and carries the dust arising from the wheels, with it, into the artificial channel under the cars, and confines it until it escapes at the end of the train. The open mouths of the deflectors, on the sides of the cars, also serving as channels for any side dust which may come in contact with them, to be sucked through into the central channel, substantially as described. I also claim the manner described, of reversing the deflectors so that they will effect the desired object, in whatever direction the train is going, substantially as specified."

46. For an *Improvement in Machinery for Mortising Frames for Window Blinds;* D. M. Cummings, North Enfield, New Hampshire.

Claim.—"What I claim is, the movable platform, spacing gauge, and oblique ways, when combined and arranged with each other, and with the adjustable gauge bits, &c., or their equivalents, in such a manner that the mortises formed will be exactly equi-distant from each other, and also, in such a manner that any desired degree of inclination may be given to the said mortises, substantially as herein set forth; disclaiming the use of the said movable platform, save when employed in combination with the spacing gauge and oblique ways, as set forth."

47. For an *Improvement in Clamps for Holding Steel Plates while being Hardened and Tempered;* Charles W. Fillmore, Coral, Illinois.

Claim.—"What I claim is, making the ribs wedge-shaped, thick exteriorly, and thin at the edge where they come in contact with the plate undergoing hardening."

48. For an *Improvement in Attaching Cross Bar Fastenings to Vault and Safe Doors;* F. C. Goffin, City of New York.

Claim.—"What I claim is, the described groove and cross bar, constructed and arranged in the manner and for the purpose substantially as set forth, in combination with the doors, designed to be fortified and secured thereby."

49. For an *Improvement in Cotton Gins;* Benjamin D. Gullett, Aberdeen, Miss.

Claim.—"I am aware that brushes have been so arranged in gins that their bristles extend between the saws, but in such manner that the sides of the bristles would act against the fibre; therefore, I make no claim to any arrangement of bristles acting in that manner, my invention being confined to such an arrangement of the brushes that their bristles will act endwise against the fibre, in which position they are found to brush out the motes with much better effect than in any other; what I claim is, the combination of the mote brushes, arranged and operating in the manner described, with the saw and stripping brushes, substantially as specified."

50. For an *Improvement in Machines for Pegging Boots and Shoes;* Halvor Halvorson, Hartford, Connecticut.

Claim.—"What I claim is, the automatic combination, composed of the following elements, or their mechanical equivalents. 1st, A frame or boot holder. 2d, Machinery for moving the boot holder horizontally, in directions both towards and away from the awls or hole-making contrivances, or in accordance with the horizontal or peripheral curvature of the sole, such mechanism being the guide and bearing point, or tracer, and return spring. 3d, Machinery for raising and depressing such boot holder, in accordance with the vertical curvature of the sole, such mechanism being the guide or cam, and the second frame with its tracer. 4th, Mechanism to give the boot its movement from heel to toe, or vice versa, under the awls or pricking machinery, such mechanism being the screw, cogged wheel,

pawl, or lever, connecting rod, and crank pin, on shaft. 5th, Machinery for holding the strip or strips of wood from which the pegs are to be cut, and regularly advancing such strip or strips, in manner required, towards the cutters, the same consisting of the troughs, and slide or carriage, arranged and operated as described. 6th, A series of cutters, or cutter knives, so made to operate as to cut from the peg strip, pegs, as explained, and hold or retain the same by friction between them, and move such pegs forward to, and directly over the holes in the sole, previously made by the awls or pricking machinery. 7th, Machinery for pricking the holes in the sole, for the reception of the pegs. 8th, Machinery for pressing or forcing such pegs into holes, such being accomplished by the plate, carried and forced down by the punch. 9th, A rocker frame, or swinging lathe, made to support and carry the mechanism above denoted, as the fifth, sixth, seventh, and eighth elements of combination. 10th, Machinery for giving or imparting to such rocker frame its proper movement to insure the correct direction of the awls impuncturing any hole or holes in any part of the sole, such machinery being the movable guide and the tracer, the latter being attached to the rocker frame. And, as auxiliary to the above, or as an improvement, I claim the reversible plate or awl holder, made capable of being turned around, substantially in manner and for the purpose as herein before stated. And I also claim the improvement of so arranging, as described, the awls and machinery that cuts the pegs from the strips of wood, and brings them forward and forces them into the holes, that there shall always be one or more holes made in the sole between the pegs that are being simultaneously made in the sole."

51. For an *Improvement in Heaters for Smoothing Irons;* James J. Johnson, Allegheny City, Pa.

"The nature of my invention consists in giving to a box iron for smoothing clothes, a central conducting mass, for carrying, by means of a largely increased surface and body, the caloric of the heater directly to the smoothing surface of the box iron, this central mass being cast in one body with the box iron, and it and the heater and the box iron corresponding in shape, the one to the other, the heater being thus made in a way to prevent its usual warping, and also to give out a greater amount of heat than could otherwise be attained."

Claim.—"What I claim is, the raised body, as described, and for the purposes described, in its combinations with the heater, with the large central opening to fit the raised body, the raised body, the outer shell of the box iron and the heater being adapted in shape and depth, the one to the other."

52. For an *Improvement in Self-Heating Smoothing Irons;* John Johnson, Allegheny City, Pa.

"The nature of my invention consists in making a hollow iron, with the upper part of the bottom convex, and with two flues commencing at the back end of the iron, which run along the bottom and sides, and unite at the point of the iron."

Claim.—"I do not claim the chimney, wooden handle, and the fastening for the top, &c.; neither do I claim, in general, the use of a distributing flue over the bottom of the iron, as that device has been used before in the self-heating flat-iron of Talieferro & Cummings, patented March 30, 1852; but what I do claim is, the flues around the edge of the bottom, as herein described, in connexion with the convexity of the upper part of the bottom of the iron, for the purpose herein mentioned."

53. For an *Improvement in Machines for Squeezing and Compressing Metallic Bodies;* Ebenezer A. Lester, Boston, Massachusetts.

Claim.—"What I claim is, giving to the hammer or compresser, a positive reciprocating motion, by means of the toggle joint, having a movable fulcrum to let down the hammer as the substance acted upon is being reduced, substantially as described, when this is combined with the bed, composed of rollers, or the equivalent thereof, to hold and turn the ball, or other body, for the repeated actions of the hammer, as set forth."

54. For an *Improvement in Flexible Cordage;* Henry H. Matteson, Buffalo, N. York.

"The nature of my invention consists in forming a cord, line, or belt, which shall be sufficiently flexible to be used, and yet not stretch or shrink by use or exposure."

Claim.—"I lay no claim to the making of cable or cordage of iron; but what I do claim is, the method of making flexible cordage, impervious to moisture, and that will not shrink or stretch by use or exposure, by forming the body or core shreds of whalebone, bamboo,

or rattan, covered by a water proof coating, and the whole completely by plaited thread, substantially as described."

55. For a *Machine for Cutting Ellipses;* Wm. G. Merrell, Auburn, New York.

Claim.—"I do not claim the employment of the trammel, for that is well known as an old device; neither do I claim the method of raising and lowering the bed, that being also an old device; but what I do claim is, the manner in which the driving pulley and cutter stock is made to rotate firmly on the trammel plate, viz: having ways on the upper surface of the trammel plate, and a circular ledge or projection on the under surface, and causing the pulley and cutter stock to press firmly against the ways and ledge or projection, by means of the pins, screws, or nuts, as described."

56. For a *Machine for Matting the ends of Blocks in Making Matches;* Henry E. Pierce, Charlemont, Massachusetts.

Claim.—"What I claim is, matting the ends of match blocks by means of rollers, for the purpose as set forth. And in this claim I do not confine myself to the precise arrangements of the parts described, but shall vary them at pleasure, while I attain the same ends by means substantially the same."

57. For an *Improved Gold Separator;* David Pierce, Woodstock, Vermont.

Claim.—"What I claim is, the gold separating cylinder, with the stepped inclined interior surface and valve opening, constructed and operating as described, or any other substantially the same, and which will produce the intended effect."

58. For an *Improvement in Saw Gummers;* J. P. Spoffard, Brocket's Bridge, N. Y.

Claim.—"What I claim is, the combination of the cutter and collar with the recesses, and so as to change the cutter, when the teeth become dull from use on one part, to the other part, where they are sharp, and thus make it perform double service, substantially as described."

59. For an *Improved Float Valve for Discharging Condensed Water;* Caleb C. Walworth, Boston, Massachusetts.

Claim.—"I claim, in combination with the float, the outlet tube, the valve and opening, (or the mechanical equivalents of said valve and opening,) the second valve and opening, (or the mechanical equivalents for such valve and opening,) so arranged and applied to the tube, and the vessel or float, as to operate to counteract the pressure on the other, or first valve, under circumstances and for the purpose substantially as specified."

60. For an *Improvement in Valves and Valve Seats of Steam Engines;* Stephen D. Wilson, Reading, Pennsylvania.

"The nature of my invention consists in the enlargement and peculiar construction of the steam ports in the valve seats of steam engines, and in adapting the valve to these ports so as to exhaust steam from one end of the cylinder with much greater rapidity than it is admitted into it at the other; all of which is to be accomplished by the same motion, with a single slide valve, and by this means diminish the resistance of the exhaust steam, and increase the power and speed of the engine, with a saving of fuel."

Claim.—"What I claim is, the enlargement and peculiar construction of the steam ports in the valve seats of steam engines, and figures 2 and 3, and in adapting the valve, figure 1, to these ports, so as to exhaust the steam, as herein described, using for that purpose the aforesaid shape and figure, or any other substantially the same, and which will produce the intended effect; and I hereby disclaim title to any original invention of slide valve, valve seat, steam ports, eccentric motion, and any else heretofore known, on which my improvement may be founded, confining my claim strictly to the improvements made on them, as herein described."

61. For an *Improvement in Bedsteads;* Jno. H. Barth, Indianapolis, Indiana.

Claim.—"What I claim is, the notched cheeks, in combination with the shank and catch, as described, for fastening the post to the inner frame, by inserting the shank between the cheeks, in the manner set forth, and giving the post a vertical position, and also causing the speedy disconnexion of the same by the inward inclination of the foot of the post, substantially as specified."

62. For an *Improvement in Torch Lamps;* Harvey Brewer, East Boston, Mass.

Claim.—"I am aware that torches have been adapted to cylindrical reservoirs contain-

ing burning fluid, the handle of the torch or swab closing the mouth of the reservoir and extinguishing the fluid, should it chance to be ignited by returning the torch while burning; I do not, therefore, claim such a device; neither would it answer the purpose where the reservoir is not stationary, or where it is to be attached to the person; neither do I claim any of the details of the construction of my lantern, except such as I shall hereafter specify; nor do I claim the lantern itself, as new, nor the making use of camphene, or any similar fluid, for the purpose of lighting street or other lamps; but what I do claim is, the peculiar construction of the reservoir for containing the camphene, that is to say, the combination of the exterior tube with the interior tube, for the purpose of preventing the liquid from being spilled, should the lamp be overturned, while the reservoir is at all times open for the reception of the torch."

63. For an *Improvement in Filters;* Jno. Kedgie, Rochester, New York.

Claim.—"What I claim is, constructing a filter with an inverted jar, or reservoir, having a detachable perforated base, or bottom, of a concave form, with a flanched or rim edge, having a slot, substantially as set forth."

64. For an *Improved Mortising Chisel;* J. W. McGaffey, Philadelphia, Pennsylvania.

Claim.—"What I claim is, the construction of the chisel, substantially in the manner shown and described, viz: having two cutting lips inserted in a slot or recess in the lower end of a stock, said lips working upon pins which pass through the stock. The inner surfaces of the lips being constructed as shown, and having a tongue working between them, which tongue, when the chisel is raised, forces apart the cutting edges of the lips, and throws out the chip from between the said lips; the cross-bar of the tongue, when the chisel descends, throwing apart the upper portions of the lips, and closing the lower and cutting ends, the tongue being raised between the lips by means of the spring, or its equivalent."

65. For an *Improvement in Mortising Machines;* Hezekiah B. Smith, Lowell, Mass.

Claim.—"What I claim is, the combination for reversing the chisel, by power applied by friction, (with band, or otherwise,) and stops, operated so as to stop the chisel when reversed, in the manner essentially as set forth."

66. For a *Magnetic Toy called the Magnetic Cupid;* James Swain, Philadelphia, Pa.

Claim.—"What I claim is, the combination of the question blocks with adjustable holes, the sliding piece, the toothed wheel, the rotating bar magnet, and the exterior cupid, in the manner and for the purpose, substantially as described."

67. For an *Improvement in Feathering Paddle Wheels;* Thos. L. Jones, Poughkeepsie, N. Y., Assignor (through Horace Dresser) to James B. Jones, City of New York.

Claim.—"I claim, in combination with the mode described, of maintaining the paddles in parallel planes, by means of the suspension ring, making the wheel and paddles in two parts, with a space between for the reception of the suspension ring, substantially as and for the purpose specified."

JANUARY 17.

68. For a *Spiral or Worm-Joint Hinge;* Perry G. Bates, Waterbury, Connecticut.

Claim.—"What I claim is, the spiral or worm-joint hinge, constructed as described."

69. For an *Improvement in Saliva Pumps;* F. Davison, Liberty, Virginia.

Claim.—"What I claim is, drawing the saliva from the mouth, and keeping it dry, during the operation of filling teeth, by means of an instrument constructed with a hollow mouth-piece, which connects with a tube and suction and force pump, in the manner essentially as described."

70. For an *Improvement in Machines for Pegging Boots and Shoes;* Jno. James Greenough, City of New York.

"My invention consists of certain parts, which are for the purpose of forming and driving pegs of wood or metal, into the soles of shoes, boots, &c., or other similar manufactures, and in moving the work up to the pegging apparatus."

Claim.—"What I claim is, 1st, Cutting the peg from the peg blank, by a lateral motion of the cutter against the side of the blank, the cutter assisting to hold the blank in position while it is driven, substantially as described. 2d, I claim the combination of parts, con-

sisting of a revolving plate, surmounted by slides, moving at right angles to each other, when this is combined with the resting of the axis of the revolving plate upon a weighted lever, or its equivalent, so as to rise and fall, for producing a universal movement carriage, as described. 3d, I claim the centre guide for directing the movement of the shoe, or other article, in the course indicated by the groove, or other device substantially the same, for the purpose of keeping the line of the pegs coincident with that of the awl and peg driver. 4th, I claim so constructing, arranging, and operating the shoe carriage, that each point of the sole which is to receive a peg shall be brought successively to the same point under the pegging standard, so that the pegging shall be effected automatically, and without interruption, entirely around the shoe, or other article, substantially as described. 5th, I claim, in combination with the movable carriage, the stationary pegging standard, made adjustable, so that it can be set at any required distance from the centre of motion of the carriage holding the material to be pegged, as above set forth, so that a second row of pegs may be driven within or without the first row, with the same pattern, as described. 6th, I claim driving the pegs by a tool having a positive motion, as described, in both directions. I do not intend, by the above claims, to secure or have granted to myself, any device or combination contained, either explicitly or substantially, in letters patent granted to Joel Robinson, dated October 31st, 1848, or in the specifications, drawings, or model, upon which said patent was granted."

71. For an *Improvement in Diaphragm Pumps;* Daniel T. Hitchcock, Warren, Mass.

Claim.—"I do not claim the pinching of the diaphragm between plates with parallel sides, as this has been done before; but what I do claim is, the securing of an elastic diaphragm between the plates, the sides of which are so inclined as to gradually compress the diaphragm, and take up its elasticity, by which means it is prevented from cutting, substantially as described."

72. For an *Improvement in the Manufacture of Boot and Shoe Soles of Gutta Percha or India Rubber;* E. C. Hyatt and Christian Meyer, Milltown, New Jersey.

Claim.—"What we claim is, 1st, Producing a shoe sole, or other analogous manufacture, in india rubber and gutta percha, in one piece, having variety of thickness in different parts, by the use of rollers, whose surfaces present the reverse of the forms to be produced, at a single operation, substantially as described. 2d, Forming soling of india rubber, or gutta percha, with shanks, fore parts, and heels, of appropriate differences of thickness, in one solid piece, and at one operation, as described. 3d, We also claim forming such soling, or analogous manufacture, in continuous sheets, at one operation, by rolling, as described."

73. For an *Improvement in Machines for Mincing Meat;* Abraham McInturff, Liberty, Virginia.

Claim.—"What I claim is, the employment of the compound cutters, as described, in combination with the holders, operating substantially as and for the purposes set forth."

74. For an *Improvement in Pill Machines;* Loriston G. Merrell, New Bedford, Pa.

"The nature of my invention consists in constructing a machine which will roll the pill mass in a thin sheet, cut it into worms, and then roll it into pills afterwards, coating them with sugar, or any other substance which may be desired."

Claim.—"What I claim is, the combination of machinery, described in my specification as follows, to wit: I claim the revolving segment, with the arrangement of lever and ratchet attached, moving the knife in the manner described; also, the peculiar operation of the fingers which support the pill worm until the proper time for dropping it between the segment and concave, with the coating box attached, and moved as aforesaid, or any other arrangement of machinery substantially the same, and which will produce the intended effect."

75. For an *Improvement in Apparatus for Indicating the Action of the Feed Pump in Steam Boilers;* Thomas J. Sloan, City of New York.

Claim.—"What I claim is, combining with the motor which operates the supply cock or valve, and with the supply pump, or with either, as specified, a mechanism, substantially as specified, which, when the said motor and pump, or either, fail to operate, shall operate the valve of the whistle, or other alarm, to give warning that the apparatus needs personal attention, with the view to perfect safety, as specified."

76. For an *Improved Photographic Plate Vice;* C. W. Stimpson, Cleveland, Ohio.

"The nature of my invention consists in such a construction of the vice, that all the surface of the plate is exposed to the action of the polishing wheel or buffer, with no part of the instrument projecting above the surface of the plate, and so compact and complete within itself, that it can be used in the hand upon a wheel, or be fixed stationary to the bench."

Claim.—"What I claim is, the bed plate, with the ways, in combination with the carriage plate, with the projection and T head and lip, operating in conjunction with the lip upon the main frame. I also claim the manner of securing the carriage plate to the ways by means of the slot and T head, and moving the same backwards and forwards upon the ways, by means of the eccentric or cam lever, in the manner specified. I also claim the arrangement by which the carriage plates can be changed from one side to another, simply by bringing the lever arm back to its farthest point to the left, or in the direction opposite to the course indicated by the arrow. I disclaim the lips and the cam lever separately considered; but I do claim the several parts, in combination, as set forth."

77. For an *Improvement in Tonsil Instruments;* Ira Warren, Boston, Mass.

Claim.—"What I claim in an instrument for the excision of the tonsils, and other analogous operations, is, the crescent-shaped blades, constructed and operating in manner substantially as described, and for the purposes set forth."

78. For an *Improvement in Amputating Apparatus;* Geo. W. Griswold, Carbondale, Pennsylvania.

Claim.—"What I claim is, the combination of the adjustable rest, movable disk, and guide or standard for holding the bone, retracting the flesh, and guiding the saw in amputating limbs; the whole being made and operating substantially as described."

79. For an *Improvement in Clasps;* Chas. T. P. Ware, Assignor to David C. Morehead, City of New York.

"The nature of my invention consists in the construction of a spring clasp, combining the advantages of simplicity, solidity, economy of time and labor in the manufacture, and facility of adjustment, by any known means of securing said clasp in the position in which it is to be used."

Claim.—"What I claim is, the above described spring clasp-lock, so constructed and arranged that the laps shall, when closing, depress the wide end of the tongue, and allow it at last to spring outward into the enlarged space between and above the laps, where it is held firmly by the turned over end of the tongue, or by the thickness of the metal itself; and this I claim, whether used with the projections, for the purposes described, or without them."

80. For an *Improvement in Trusses;* Lewis B. White, Moscow, New York.

Claim.—"What I claim is, the knuckle, the stirrup, the spring, the effect of the bow, substantially as set forth."

JANUARY 24.

81. For an *Improved Copying Press;* Calvin Adams, Pittsburgh, Pennsylvania.

Claim—"What I claim is, the combination of the lever bar and upper pressing plate, connected by means of the adjusting screw, and the mode of communicating pressure to the upper pressing plate by means of a cam at the end of a lever, working at the end of the lever bar which sustains the upper pressing plate; also, the use of the finger at the end of the cam lever, in combination with the rest and the other parts of the press, for the purpose of raising the upper platen of the press, and sustaining it in its place while the copying book is inserted or withdrawn, substantially in the manner and for the purpose set forth."

82. For an *Improvement in Wood Saws;* Romes Andrews and Albert F. Andrews, Avon, Connecticut.

Claim.—"What we claim is, the peculiar form and relative position of the planing teeth, in combination with the sawing teeth, substantially as described, and for the purpose set forth."

83. For an *Improvement in Railroad Car Brakes;* L. B. Batcheller, Arlington, Vt.

Claim.—"What I claim is, operating the levers which are attached by the rods, and to

the cross bars, by means of vibrating bars, said bars being moved or operated either by turning the standard, or by the action of the buffer rods upon the levers, both devices being attached to the trucks, and otherwise constructed and arranged substantially as set forth."

84. For an *Improvement in Dumping Cars;* Charles P. Bailey, Zanesville, Ohio.

Claim.—"What I claim is, hanging or connecting the bodies of dumping cars or wagons to the trucks, axles, or bolsters, which usually support the bodies of similar carriages, by my means of hinged cross braces or arms, which pass transversely from end to end, or crosswise of the body, as the case may be, one end of each of said arms or braces being hinged to the body, and the other ends to be bearing or support beneath them, for the purpose of allowing said bodies to swing or dump either way, substantially as described."

85. For an *Improvement in Fancy Check Looms;* Enoch Burt, Manchester, Conn.

"The nature of my invention consists in the position and arrangement of the levers for operating the jacks, viz: hanging them below the web and at a point parallel with, and at about a vertical plane with the 'fell,' or cloth making point, or arranged in any manner substantially equivalent, whereby all the heddles are sprung so as to elevate and depress all the threads of the warp at the same angle, producing very smooth and even sheds, both at top and bottom, in any irregular order desired; the shifting of the jacks are rendered sure and perfect, all jarring or unsteady motion of this part of the machinery, and danger of the jacks hanging upon the said levers, is effectually prevented."

Claim.—What I claim is, hanging the levers or jack lifters below the web, and on a shaft parallel with, and at or about a vertical plane with the 'fell,' or cloth making line, so as to produce an even shed, both at the top and bottom, and render the shifting of jacks from the levers sure, avoiding the jar of the machinery, and obviating the liability of the jacks to hang on the flanches of the levers, substantially as set forth."

86. For an *Improvement in Rosin Oil Lamps;* Silas Constant, Brooklyn, New York.

Claim.—"What I claim is, enclosing the portion of the wick which rises above its guide, within a perforated conical tube, for the purpose of causing a portion of the air that enters the chamber between, and to be brought in contact with the wick which is there in an uncompressed state, and to rise in and about the same to the flame, substantially as set forth. 2d, The draft tube, placed within the burner, and having the button and the perforated and deflecting head combined therewith, substantially in the manner and for the purpose set forth. 3d, The lip, projecting downwards from the under side of the cap, within the series of air holes in the same, for the purpose of preventing gusts of air from producing puffs of smoke up the chimney, substantially as set forth."

87. For an *Improvement in Washing Machines;* William Cunningham, Holliday's Cove, Virginia.

"The nature of my invention relates to the method of hanging the rubber frames so that they may oscillate through the water."

Claim.—"I do not claim the general features of the rubbing frames and plunger; but what I do claim is, the roller frames hung in adjustable boxes, and connected by weighted arms, substantially as and for the purpose described."

88. For an *Improvement in Bee Hives;* John H. Dennis, Boston, Massachusetts.

Claim.—"What I claim is, a moth trap, consisting of a close chamber, having no communication with the rest of the hive, and in which may be placed a vessel containing some fluid attractive to the bee-moth, in combination with a conical or tapering entrance tube, as set forth."

89. For an *Improved Attachment to Piano Fortes;* Spencer B. Driggs, Detroit, Mich.

Claim.—"What I claim is, 1st, The combination of a series of metallic tongues or springs, with the piano forte, or other stringed instrument, in such a manner that a tongue and a string are struck simultaneously, by hammers actuated by a single key, substantially as described. 2d, Actuating the hammers which strike the tongue by means of a jack of any suitable form, attached to the damper of its corresponding string, whereby the said hammer is caused to strike by the raising of the damper, when the piano forte action is brought into play, and thus the tongue and string are struck simultaneously."

90. For an *Improvement in Air Heating Furnaces;* Charles R. Harvey, City of N. Y.

Claim.—"I do not claim a diving flue, or a coil of heating pipe, as they are both well

known devices; but what I claim is, constructing the bonnet or top of the fire chamber with a depression at the centre, into which the smoke or exit pipes enter, so that the heat is equalized all around, and the expansion and contraction is made uniform, as specified."

91. For an *Improvement in Stoves;* Dennis G. Littlefield, Lowell, Massachusetts.

Claim.—"What I claim is, the cylindrical grated fire pot, in combination with the gas receptacle, constructed and operating in the manner substantially as described, by which I am enabled to burn the gaseous and more inflammable elements of the coal in immediate contact with its more refractory portions, and thus ensure the complete combustion of them both."

92. For an *Improvement in Ventilating Railroad Cars;* George Neilson, Boston, Mass.

Claim.—"What I claim is, two or more ranges of sponges, or capillary partitions, as arranged and combined with the cistern of water and open mouthed case, made to communicate with the interior of the car and the surrounding atmosphere, and to operate when the car is in movement, substantially as specified."

93. For an *Improvement in the Manufacture of Hollow Slabs and Flanched Metallic Plates;* Thomas Prosser, City of New York.

"Although I have used the term wrought iron, I mean to apply the same to all and any of the weldable metals, particularly steel and platinum; that I do not confine myself to any particular form or configuration by the term hoop or ring, as that may mean annular, round, square, oval, or any irregular form whatever."

Claim.—"What I claim is, the manufacture of hollow slabs, when the same are made by welding together pieces of metal, in the manner fully set forth and described, or in any manner analogous thereto. I also claim the manufacture of flanched metallic plates, when the same are made by welding together pieces of metal, in the manner fully set forth and described, or in any manner analogous thereto."

94. For an *Improvement in the Feed Apparatus of Straw Cutters;* Harvey Trumbull, Central College, Ohio.

Claim.—"What I claim is, the device for securing the clear passage of the straw, &c., over the intervals between the trough and mouth piece and the lower roller, consisting of fingers, attached to the trough, and passing over the said roller into or upon the mouth piece, and secured from interference with the passage of the straw, &c., by grooves in the face of the roller in which the fingers lie."

95. For an *Improvement in Mills for Grinding Sumac;* Peter Hench, W. S. Hench, and Jerome J. Hench, Port Royal, Pennsylvania.

Claim.—"We do not claim the grinding by balls, as that has long been known, but not in conjunction with a roller, in the manufacture of sumac, which is necessary to detach and partially pulverize, sift the material before carrying it to the balls; what we do claim is, the employment of a cylinder having projecting points or teeth on its internal surface, with a roller, having heads on its ends, on which it rolls and is kept above said teeth; said roller also having teeth projecting from its surface, interlocking with those first named on the cylinder, by which the better portions of the sumac are beaten off and passing through the apertures in the cylinder, enter another, when they are ground fine, as described."

96. For an *Improvement in Machinery for Fulling Cloth;* James H. Jennings and Thomas Brierly, Clayville, New York.

Claim.—"We do not claim either of the individual parts thereof, when taken alone: nor do we claim the combination of the gatherer and horizontal and vertical rollers or fold breakers with a cylinder or wheel, or cylinders or wheels, having a groove therein of flanches on each side, and a cylinder or wheel fitting and working in such groove, or between such flanches; nor the weights and springs to be used upon any or all of such rollers or fold breakers and pressure rollers; but what we do claim is, the application of the above named rollers, formed with flat surfaces, in combination with the gatherer, the horizontal and vertical rollers or fold breakers, and guide, substantially in the manner set forth."

97. For *Improvements in Piston Valves and Steam Passages in Cylindrical Steam Chests;* Joseph Marks, Boston, Massachusetts.

Claim.—" What I claim is, 1st, Constructing a steam chest with continuous circular ports or passages, both for the induction and exhaust steam, arranged as described, so as

to keep a constant and equal pressure of steam upon both ends, and the periphery or outer surface of a cylindrical piston valve, which travels in the bore of the same, and by which, also, is secured a large area of port by a very small movement of the valve; and this I claim, whether the said valve be used as a main valve, cut-off, or throttle valve. 2d, The combination of a piston valve, composed of two heads, which fit closely in the bore of the circular steam chest, and are united by a cylindrical portion of less diameter than the said heads with a steam chest, constructed with circular ports or passages, as specified in the foregoing claim, by which a large exhaust space is secured without increasing the size of the said steam chest, or making it very large, and by which means alone provision is made for the escape of the exhaust steam into the exhaust chamber."

98. For an *Improvement in Threshers and Cleaners of Grain;* James Robinson, West Hebron, New York.

Claim.—"What I claim is, the mode of checking the motion of the carriage when under headway, and steering the same by means of the tightening pulleys, combined as described with the threshing cylinder and a two wheel cart with double gearing. 2d, I also claim the employment, in the manner substantially as described, of the adjusting rods, in combination with the feed roller, for the purpose of regulating the amount of material to be taken up by the feed roller, as explained. I also claim the employment of said adjusting rods, in combination with the feed roller and threshing cylinder, for the purpose of regulating the amount of material to be taken up by the feed roller, and of keeping up the material to the threshing cylinder. I also claim the combination of the adjusting rods, feed roller, and gauge rods, substantially in the manner set forth. I also claim the combination of the gauge rods with the feed roller and concave, or mouth of the concave of the threshing machine, substantially in the manner described."

99. For an *Improvement in Piano Fortes;* Alexander Hall, Lloydsville, Ohio.

Claim.—"I do not claim the employment of extra strings, or extra bridge or bridges, for the introduction of the lower octave notes, as they are set forth in the patent of Simon Draper, granted June 20th, 1845, in which an extra bridge is used, outside the regular bridge, thereby elongating the instrument; but I shall confine my claim to the upper octave strings and bridges therefor, placed within the usual bridges of the piano forte. Therefore, what I claim is, 1st, The mode, substantially as described, of introducing upper octave notes in piano fortes, said mode consisting essentially in the employment of extra strings and extra bridges, as set forth, so that the performer can play in one or more octaves at the same time, with the same facility as he could execute ordinary music on the common piano. 2d, I claim the arrangement of the dampers for the octaves, in combination with the alternate changes of the two upper octave strings to the right and left of the leading strings in each set, for the purposes and substantially in the manner set forth."

100. For an *Improvement in Attaching Shafts to Wagons;* Daniel Haight, Jr., Clinton, New York.

Claim.—"What I claim is, attaching the shafts or tongue, by the lateral insertion of the cylindrical headed drawiron into the circular socket of the jack, by which I am enabled to form a safe and ready detachable connexion between the shaft or tongue and axle, without the use of bolt and nut, or bar, or any intermediate means."

101. For a *Machine for Wetting Paper;* Wm. Overend, Cincinnati, Ohio.

Claim.—"What I claim is, 1st, The yielding gauges, constructed substantially as described, and for the purpose specified. 2d, The combination of the endless bands, the nippers, the rollers, the roller and their bands, the roller with its bands, and counter-balance the carriage with its vertical arm, the pieces, the bent levers, and the cams, constructed and combined substantially as described, for the purpose of taking the wetted paper from the blanket, and conveying it to the movable platform or truck, as set forth. 3d, The combination of the sliding pieces, moving in the vertical grooves, with the arms and the rollers, constructed and combined substantially as described, for the purpose of adjusting the depositing apparatus to the height of the pile of paper, as specified. 4th, The combination of levers with the roller and curved groove, arranged substantially as described, for the purpose of maintaining a uniform tension of the bands, in every position of the depositing apparatus."

102. For an *Improvement in Grain Harvesters;* Aaron Palmer, Brockport, New York, and Stephen G. Williams, Janesville, Wisconsin.

Claim.—"We do not claim the discharging the cut stalks and heads of grain from a

platform by means of the combination of a rake with a lever, and the co-operation therewith of a series of teeth on the face of the main driving wheel, and an inclined rail rising above the curved guard of the platform, as these are already secured to us by letters patent, bearing date July 1st, 1851; but we do claim the method of transferring motion to the rake on the platform from the driving wheel, by means of the double curved rack and pinion on the axle of the driving wheel, the iron arm, latch, and spring, as described. Also, the method of hanging the reel so as to dispense with any post or reel bearer next to the standing grain, as described; thereby preventing the grain from getting caught and being held fast between the divider and a reel supporter."

103. For an *Improvement in Rolling Axles and Shafts;* Jacob Reese, Sharon, Penna.

Claim.—"What I claim is, the method of shaping bars of heated iron into axles and shafts of the usual proportions, and with collars and journals, by rolling them on their own axes, and under pressure between properly shaped converging surfaces, substantially as described: but I make no claim to mere converging surfaces, whether fixed or movable."

104. For an *Improvement in Threshers and Separators of Grain;* Charles R. Soule, Fairfield, Vermont.

"The nature of my invention consists in the arrangement and construction of the straw carrier, the beaters connected therewith, the shoe and its appendages, and the movable board under the straw screen."

Claim.—"What I claim is, 1st, The spring at the end of the feed board, to prevent damage from stones getting into the machine. 2d, The straw carrier and separator, consisting of the notched bars having an endway motion, and the beater, as specified, combined with the movable conducting board for insuring the descent of the grain. I also claim the mode of hanging and moving the shoe, as described."

105. For an *Improved Machine for Making Window Blinds;* Moses C. Stiles and Tristram S. Lewis, Hollis, Maine.

Claim.—"We do not claim the cutter, chisel, or any part of the machine, separately; but what we do claim is, the combination of the cutter and chisel, worked simultaneously by the foot of the operator, or by other power, in the manner and for the purposes set forth."

106. For an *Improvement in Distilling Apparatus;* Carl E. Werner, New Castle, Ill.

Claim.—"What I claim is, 1st, The rim, rising from the floor of the chamber, and encircling the discharging opening of the conducting pipe, for prevention of the interference of steam with the discharging action of said pipe. 2d, Surrounding the entrance of the conducting pipe with an open tubular screen, which rises above the pipe entrance to a height greater than any possible ebullition of the liquid, and terminates below at such portion of the liquid as it is desired to discharge from."

107. For an *Improved Mortising Machine;* Jacob E. Brown and Stephen S. Bartlett, Woonsocket, Rhode Island.

Claim.—"What we claim is, operating the chisel by the graduated conical cam, in combination with the mechanism described, or its equivalent, which enables the operator to vary the length of the stroke made by the chisel while it is in operation, or suspend its motion at pleasure, without disconnecting the driving power applied to operate the machine."

JANUARY 31.

108. For an *Improvement in Presses for Making Miniature Cases;* Henry T. Anthony, City of New York.

Claim.—"What I claim is, the construction of the platens of a press for applying the covering materials to miniature and other like cases, by forming the face which gives the pressure of elastic materials, whereby the embossed or other raised figures and ornaments will not be obscured or injured during the process, while, at the same time, a superior quality of work is produced, substantially in the manner set forth."

109. For an *Improved Daguerreotype Plate Holder;* Philander H. Benedict, Syracuse, New York.

Claim.—"What I claim is, the arrangement of a vice, or analogous device, upon the side or edge of blocks used for holding daguerreotype plates while they are being polished or buffed, the vice constructed substantially as set forth, and operating by holding the bent edge of the plate between its jaws."

110. For an *Improvement in Cultivators;* Enos Boughton, East Bloomfield, N. Y.

"The nature of my invention consists in running the knife in nearly a flat position, at any required depth under ground, and thereby cutting up and loosening the soil, and also cutting off the roots of thistles, &c., growing therein, and thereby causing them to wilt and die."

Claim.—"I do not claim any part of the raising and depressing device; nor do I claim the knife, or the wheels, separately; but what I do claim is, the combination of the knife with the wheels, for the purpose of cutting up the ground and destroying thistles, or any other weed, plants, or grasses therein."

111. For an *Improved Mode of Fixing Likenesses in Monuments;* Wm. Boyd, Garrettsville, Ohio.

Claim.—"What I claim is, combining with a monument or grave-stone, a case, having a concave mirror set in the back part, and having also within it a miniature likeness of the deceased, which may be kept secure from the action of the weather, or from liability to receive other injury, said miniature being attached to the cover of the case in such way that by opening the cover, the likeness may be viewed by reflection in the mirror, substantially in the mannner set forth."

112. For an *Improvement in Fountain Pens;* William Cleveland, Orange, N. Jersey.

Claim.—"I do not claim the employment of capillary action to supply the ink to the pen, except when used under an arrangement and combination like that herein set forth; said arrangement and combination consisting in the employment of the leading stem so fixed in the delivery aperture that it shall lead the ink down on one side of the aperture, and allow the air to enter the other, in the manner and upon the principles set forth."

113. For an *Improvement in Presses for Moulding Glass;* William O. Davis, Pittsburgh, Pennsylvania.

Claim.—"What I claim is, the combination of the rocking shaft, connecting rods, swinging beam and toggle joint lever, or their mechanical equivalents, as described, for the purpose of procuring a vertical pressure in presses, together with the mode of attaching them so as to relieve the bed plate and frame work of the press of any strain."

114. For an *Improvement in Divided Railroad Axles;* S. L. Denney, Christiana, Pa.

"The nature of my invention consists in forming a gradual conical enlargement for a considerable distance toward the inner end of one part of the divided axle, and terminating said enlargement with greater and constantly increasing abruptness to the end of the axle, and inserting the enlarged end thereof in a cylindrical box, which connects it with the other part of the combined axle, and whose cavity is large enough to admit a layer of some soft metallic alloy to be cast around said enlargement, for the purpose of rendering the combined axle sufficiently inflexible not to wabble, and also to allow one part of it to freely turn, independently of the other, while traversing curves of the road, substantially as described."

Claim.—"What I claim is, the gradual conical enlargement, terminating in the more abrupt curved portion toward the inner end of one part of the axle, in combination with the alloy surrounding it and the adjustable connecting box, arranged and operating as described."

115. For an *Improvement in Cotton Presses;* Cyrus J. Fay, North Lincoln, Maine.

Claim.—"What I claim is, the use of the slats or guide strips, arranged and operating in manner substantially as set forth."

116. For an *Improvement in Saw Mills;* Eleazer W. Johnson, Perth Amboy, N. J.

Claim.—"What I claim is, the arrangement of mechanism for driving two saws or gangs of saws, and placing the whole upon one bed plate, in the manner and for the purposes set forth."

117. For an *Improvement in Propellers;* Harry Leach, Boston, Massachusetts.

Claim.—"What I claim is, the combination with each of its arms, of two parts or floats, (projecting in opposite directions,) and an opening or passage arranged between them for the escape of back water, the whole being substantially as described."

118. For an *Improved Apparatus for Cleaning, Buffing, &c., Daguerreotype Plates;* Thomas Longking, Brooklyn, New York.

"The nature of my invention consists in means for cleaning the plate previous to buf-

fing; this has heretofore been done by hand, the operator using a piece of Canton flannel, on which he puts rotten stone and oil, or similar cleaning material, and rubbing the daguerreotype plate all over with the same, and for this purpose a plate holder is used that can be turned around with one hand, while the plate is cleaned with the other; to accomplish the same object, I use a rotary cushion, over which a cover of Canton flannel, or similar substance, is put, and secured by a ring, the daguerreotype plate being applied to the rotating cushion while held in a proper plate holder, and, in connexion with this cleaning cushion, I use a buffing wheel to finish the polishing of the plate."

Claim.—"I do not claim the buffing wheel, nor any of the parts, separately; but what I do claim is, 1st, Fitting the revolving cushion with the ring, by which the Canton flannel, or similar covering, is secured to the cushion, or removed, and a new cover substituted when required, as specified. 2d, The arrangement of the gearing and shafts, by means of which the cleaning cushion is combined with the buffing wheel, in the manner substantially as set forth."

119. For an *Improvement in Quartz Crushers;* T. O. Cutler, Jersey City, N. Jersey.

"My invention consists in grinding, crushing, or pulverizing quartz, ores, and other substances, by the centrifugal action of rotating or rolling balls that revolve about an axis, when combined with and acting against the inner periphery of a shell or concave which rotates on a common axis with the balls, which shell or concave contains the substance to be ground, &c., which, by the centrifugal action due to the rotation of the shell or concave, is properly distributed, and held in the gutter-like concavity of the shell to be acted upon by the balls in their passage."

Claim.—"What I claim is, the employment of balls to act by centrifugal action due to their rotation about a common centre, substantially as specified, when the said balls are combined and act against the inner periphery of a shell or concave, which rotates on a common axis with the balls, and which, by reason of its rotation, distributes and holds the material to be ground, &c., in the concavity of the said shell, substantially as specified."

120. For an *Improvement in Shutter Hinges;* Harvey Lull, South Coventry, Conn., Assignor to Self and Richard Porter, Wheeling, Virginia; dated January 31, 1854; ante-dated January 2, 1854.

Claim.—"What I claim is, the so forming of a self-locking shutter hinge, cast in two pieces, as that the blind or shutter hung thereon may swing open or shut on a horizontal plane, and lock when opened to its limit, and so that also when locked open, the strain shall be taken off from the spindle and thrown on to cam arms, and thus effectually relieve the spindle from the weight or strain of the shuttle, substantially as described."

121. For an *Improvement in Rollers for Scarfing the Edges of Skelps for Lap Welded Tubes;* James McCarty, Reading, Pennsylvania.

Claim.—"What I claim is, a pair of rollers, constructed, arranged, and adjusted, substantially as described, so as to bevel the opposite edges of skelp plates of different widths, on opposite sides of the same."

122. For *Improvements in Steam Hammers;* John L. L. Morris, Reading, Penna.

Claim.—"I do not claim attaching the hammer to a beam which is operated by a piston in a steam cylinder, when the hammer is connected rigidly to the beam, as that would be equivalent to what is known as the helve steam hammer; but what I claim is, 1st, Admitting steam to the cylinder above the piston, and exhausting the steam therefrom through ports, and which are opened and closed by an annular valve working in the cylinder itself, or in a steam chest, which is placed above and forms a continuation of the cylinder, substantially as described. 2d, I claim the combination of a bell crank latch lever with a trigger or catch of, or other shape, capable of operating, as described, when the fulcrum of the said catch lever block and one end or arm is attached to the connecting rod of the hammer block, and receives the necessary movement to actuate the trigger or catch, to set free the valve rod by means of a continued descent of the connecting rod after the hammer is arrested by striking the blow, as and for the purpose set forth."

123. For an *Improvement in Electro-Magnetic Engines;* Chas. G. Page, Washington, District of Columbia: patented in England, May 3, 1851.

Claim—"What I claim is, the employment of the axial action or force of the electric current as a mechanical agent or motive power, for the various purposes herein named, the power being produced by the combination or united operation of a helix or helices, an axial bar or bars of iron, and a cut-off, or its equivalent, for regulating the motion of

the axial bar or bars, under a general arrangement in principles substantially as set forth. And I also claim the employment of co-operating electro-magnets or armatures, in combination with axial bars, helices, and cut-off, or its equivalent, substantially as set forth. Lastly, I claim the employment of square wires in the construction of helices for electro-magnetic purposes, substantially as set forth."

124. For *Improvements in Water Gauges for Steam Boilers;* W. Palmer, City of N. Y.

Claim.—"What I claim is, the use of the double tubular case, in combination with the lever, having a float at one end working in one of the tubes, and a compensating plate, or equivalent device, at the other, working in the opposite tube, for the purpose substantially as set forth. I also claim the use of the lever, having a float at one end of it, and a compensating plate at the other, whether working in a double tubular case, or otherwise, in combination with an upper and lower rod valve for operating a ball by means of the steam escaping through these valves, whether using the paddle wheel, or any equivalent device, for that purpose, to indicate the minimum or maximum of the water in the boiler, substantially as set forth."

125. For an *Improvement in Manufacture of Sheet Iron;* Ebenezer G. Pomeroy, Pittsburgh, Pennsylvania.

Claim.—"I do not claim the use of the above materials, in combination, as a paint or composition that may be forced into the surface of iron; but, believing that I am the first person who has ever incorporated solid carbonaceous matter with the surface of iron, by mechanical force, what I do claim is, the incorporating, substantially as described, solid carbonaceous matter with the surface of iron, so as to protect it from oxidation, and beautify it at the same time."

126. For an *Improvement in the Construction of Printing Blocks;* Benjamin Underwood, Brooklyn, New York.

"The nature of my invention consists in providing a series of suitable movable types of wood, metal, or other material, and so arranging them together that they shall, collectively, constitute blocks, patterns, designs, or devices, with which ornamental figures and designs may be printed upon oil cloths, carpets, and other fabrics, in one or more colors, just the same as if the said blocks had been engraved or carved, according to the usual mode."

Claim.—"I claim the peculiar construction of the type described, so that when combined in a case, such as specified, any given design may be produced for printing oil cloths, carpets, or other fabrics, as fully set forth. I also claim the formation of blocks for printing oil cloth carpets, or other fabrics, by the combination and arrangement of sections of type, such as particularly described, by which an endless variety of patterns may be produced from the same sections, variously dispersed, at a comparatively small cost."

127. For an *Improvement in Carpet Bags;* Frederick J. Thring, City of New York.

Claim.—"What I claim is, constructing the carpet bag with its top and bottom of equal or nearly equal widths, and arranging round its front a strong metallic frame, and attaching to the front, and near the centre of said metallic frame, by hinges or loose joints, a metallic swinging cover, which extends from the centre to the top of the frame, and has a ledge on its inner face, the said cover serving to close up the mouth of the bag, and in connexion with the metallic frame, to keep out all dust and rain; the whole being constructed, arranged, and operating in the manner and for the purposes specified."

128. For an *Improved Machine for Paging Books;* Edward Town, Jersey City, N. J.

Claim.—"What I claim is, the arrangement of type in spiral columns around a cylinder, for the purpose of printing successive numbers; the cylinder being moved laterally while it revolves, by means of a screw on the end of its shaft, substantially as described. I also claim the right to use any number of cylinders on a single machine, for the purposes set forth."

129. For an *Improvement in Steam Hammers;* Peter L. Weimer, Reading, Penna.

Claim.—"I make no claim to being the originator of not admitting steam into the cylinder until after the hammer has struck its blow; the same being effected by others, though by different arrangement of device from that which I employ. I do not claim admitting steam into the cylinder of steam hammers by means of the recoil of the anvil, caused by the blow of the hammer; but I do claim the arrangement of the toggle, the catch, the arm, the arm J, the weight, and shaft, for the purpose of opening the valve admitting steam

into the cylinder from the concussion or spring of the anvil in its bed, caused by the force of the blow of the hammer."

130. For an *Improvement in Churns;* Isaac L. Dickinson, Richmond, Indiana.

Claim.—"What I claim is, the combination of the movable or rotating dashers with the breakers, constructed and operated as described, so that said breakers may remain stationary while churning, and revolve with the dashers to collect the butter, substantially as described."

131. For an *Improvement in Furniture Casters;* Le Roy S. White, Chicopee, Mass.

Claim.—"I do not claim the invention of making the shank of the caster detachable from its socket; nor do I claim the employment of a spring to hold the shank in the socket, nor the arrangement of said spring in a groove made in and around the shank, and the making the spring to bear against the internal surface of the socket, made without a groove; but what I do claim is, the arrangement of the sustaining groove of the spring in the socket, instead of in the shank, so that when the shank is being drawn out of the socket, or when it is within or out of the same, the spring will remain in the socket. And, in combination with the spring and grrove made in the socket, I claim to make the groove of the shank with its upper side flaring, and the upper end of the shank beveling, as described, or as represented in the drawings, the said flare of the side of the groove and the top, rendering the shank capable of being detached from or attached to the socket."

RE-ISSUES FOR JANUARY, 1854.

1. For an *Improvement in Utilizing Slags of Furnaces;* William H. Smith, Philadelphia, Pennsylvania; patented December 7, 1852; re-issued January 3, 1854.

Claim.—"What I claim is, the process, substantially as described, of producing ware from the slag, or scoria ejected from smelting furnaces, for reducing iron, copper, zinc, and other metals, by separating these from, and casting, moulding, blowing, or pressing the same in the heated state, as it comes from the smelting furnace, and then annealing, whether additional heat be applied, or not, substantially as and for the purpose specified. And I also claim the method of obtaining slag or scoria from smelting furnaces, in a vitrified state, fit for remelting, to be worked into ware, substantially as described, by casting it into thin sheets on to cold plates of metal, or other good conducting substance, as specified."

2. For an *Improvement in Looms for Weaving Figured Fabrics;* Cornelius W. Blanchard, Clinton, Massachusetts; patented Aug. 3, 1852; re-issued Jan. 3, 1854.

Claim.—"What I claim is, 1st, The combination of the angularly moving catch bars, operated substantially in the manner described, with the shifting hooks hung on the jacks, so as to vibrate independently thereof, for the purpose of connecting and disconnecting the jacks with the said catch bars. 2d, The method, substantially as described, of combining and arranging the parts for turning the figuring chain or cylinder in either direction."

3. For an *Improvement in Stuffing Boxes;* Thomas W. Allen and Charles W. Noyes, Greenbush, New York; patented Nov. 6, 1847; re-issued Jan. 10, 1854.

Claim.—"What we claim consists in combining with a stationary stuffing or packing box, a cup or ring, or its equivalent, through which the piston rod or shaft passes, and works so fitted, substantially as described, that the end thereof shall make a close joint by means of end pressure at the bottom of the stuffing or packing box, and be free to slide thereon laterally, to follow the vibrations of the piston rod or shaft, as set forth. And we also claim making the inner bore of the cup conical, in combination with the cut metallic rings fitted thereto, substantially as described, so that by the application of end pressure, the cut rings shall be forced into close contact with the periphery of the piston rod or shaft, and the end of the cup into close contact with the bottom of the box, as described, and thus effectually prevent the escape of steam, or other fluid, and, at the same time, permit the required lateral play, as set forth."

4. For *Improved Valves for Governors;* Junius and Alfred Judson, Assignors to Junius Judson, Rochester, New York; patented Nov. 5, 1850; re-issued Jan. 10, 1854.

Claim.—"We do not limit our claim to the special form of valve opening described, as the form may be greatly varied, and yet act upon the principle specified, as constituting the chief characteristic of our invention. Nor yet to limit ourselves to the form of the aperture or apertures, as the same end may be obtained on the same principle by the joint

form of the opening or openings and valve governing the same. Nor do we wish to limit our invention to the making of such governor valve with the aperture or opening thereof, on the principle specified, throughout the whole range of motion, as in many instances it may be advantageously employed with the said principle, acting only on a part of its range of motion, where engines are employed under such circumstances that they will not be exposed to serious perturbations above or below a certain range; but we do not wish to be understood as claiming, broadly, the making of the apertures of governor valves of capacities varying, independently of the range of motion of the valve, as the well known throttle valve, and valves with circular apertures, have not a constant increase or decrease of capacity proportioned to the range of motion. But we do claim making the opening or openings, controlled by the governor valves of steam engines of gradually increasing capacity, from the closed towards the open position, substantially in the manner and for the purpose specified. And we also claim interposing a spring between the valve cover and the set screw, or its equivalent, which determines or sets the position of the face of the valve to its seat, so that the tension of the said spring shall resist the pressure of the steam on the valve cover, and thereby produce an increased flow of steam to the cylinder, substantially as specified. And we also claim the employment of the valve lever, adjustable to the stem of the valve, in combination with a fixed indicator, substantially as specified, for the purpose of setting the valve in any required position without opening the valve box, as set forth."

5. For an *Improvement in Portable Horse Powers;* John A. Taplin, Fishkill, N. York; patented December 30, 1841; re-issued January 24, 1854.

Claim.—"I do not claim the making of the large wheel of a horse power in segments merely; but what I do claim is, such a wheel and axle, composed of a number of parts, arranged and connected substantially in the method described, so that the wheel can readily be taken apart and put together again, to facilitate the frequent removal of the horse power from place to place, to bring it near the work on which it is to be used. I also claim connecting the segments of the rim of the horse power by means of clamps, constructed as set forth."

6. For *Apparatus for Opening and Closing Gates;* Samuel G. Dugdale, Richmond, Indiana; patented October 11, 1853; re-issued January 31, 1854.

Claim.—"What I claim is, 1st, Opening, closing, fastening, and unfastening the gate, by moving the bottom of the gate in an oblique direction from and to the post upon which it is hung, as specified. 2d, I claim the use of the pendulous and vertical levers and arms, and, in combination with the hinges of the gate, the whole being operated and arranged, substantially in the manner and for the purpose as set forth."

Designs for January, 1854.

1. For the *Frame of a Footstool or Ottoman;* Charles Zeuner, Assignor to M. Greenwood & Co., Cincinnati, Ohio, January 3.

Claim.—"What I claim is, the new design, consisting in the ornamental figures."

2. For a *Hall Stove;* William Resor, Assignor to William and R. P. Resor & Co., Cincinnati, Ohio, January 3.

Claim.—"What I claim is, the ornamental design or pattern."

3. For the *Frame of a Footstool or Ottoman;* Charles Zeuner, Assignor to M. Greenwood & Co., Cincinnati, Ohio, January 3.

Claim.—"What I claim is, the new design, consisting in the ornamental figures."

4. For a *Laundry Stove;* William Resor, Cincinnati, Ohio, January 17.

Claim.—"What I claim is, the ornamental pattern or design."

5. For a *Dining Room Stove;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio, January 24.

Claim.—"What we claim is, the figures, scrolls, and mouldings, forming an ornamental design."

6. For a *Cooking Stove;* Conrad Harris and P. W. Zoiner, Cincinnati, Ohio, Jan. 24.

Claim.—"What we claim is, the ornamental design."

7. For a *Shovel and Tongs Stand;* Charles Zeuner, Assignor to M. Greenwood & Co., Cincinnati, Ohio, January 24.

8. For a *Shovel and Tongs Stand;* Charles Zeuner, Assignor to M. Greenwood & Co., Cincinnati, Ohio, January 24.

Claim.—"What I claim in these patents are, the new designs, consisting in the ornamental figures."

9. For a *Cannon Stove;* William Resor, Assignor to William and R. P. Resor & Co, Cincinnati, Ohio, January 31.

Claim.—"I claim the ornamental design or pattern."

10. For a *Stove;* Conrad Harris and Paul William Zoiner, Cincinnati, Ohio, Assignors to Alexander Bradley, Pittsburgh, Pennsylvania, January 31.

Claim.—"What we claim is, the ornamental design."

11. For a *Stove;* Peter Seibert, Assignor to Alexander Bradley, Pittsburgh, Pa., Jan. 31.

Claim.—"What I claim is, the ornamental design."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

On Alexander & Morfit's Process for Organic Analysis. By Charles M. Wetherill, Ph. D., M.D.

In the last number of the Journal, there is described an "improved" apparatus for Organic Analysis, by J. H. Alexander & Campbell Morfit. This process has been in use for some time in Germany, and was proposed by Hess, whose description may be found in *Poggendorff's Annalen* and in Erdmann & Marchand's *Journal fur Practische Chemie*, (vol. xvii, pages 98 and 399, year 1839.) It is also described in the last edition of *Rose's Chemistry*, and in the second supplement to *Poggendorff's Dictionary of Chemistry.* Erdmann & Marchand, as well as Wöhler, have employed it with modifications of their own; and since the method is an exceedingly neat and cleanly one, and since Alexander & Morfit have introduced modifications not, as I think, to its improvement, it may be worth while to occupy a short space in the Journal with a description of the process, from the above sources, and which may be illustrated by the cut in the former number of the Journal.

The combustion tube is about 17 or 18 inches in length, and instead of a stop-cock immediately before it, a rod of 10 inches in length is fastened to the cock of the gasometer to enable one to regulate the flow of the oxygen with greater delicacy than can be effected in the ordinary way, and upon the proper regulation of which depends the accuracy of the process. The tube is heated by an alcohol lamp, which consists of a long and narrow trough, connected by means of a tube, with an alcohol reservoir similar to the oil lamp with inverted cistern; wick holders of tin, of a rectangular section, are made of such size that they fit easily in the trough; these are added and lighted, one after another, as occasion requires. The contents of the combustion tube are arranged differently by different chemists; but in all cases a re-agent such as oxide of copper is necessary. This cannot, in most instances, be omitted, as Alexander & Morfit have proposed, since the greater portion of substances

subjected to analysis would give off liquid or volatile products of dry distillation, before the temperature is reached at which they would unite with the oxygen. Anthracite coal, or such bodies as would not yield volatile products at a low temperature, might, indeed, be subjected to this process. Perhaps experiment would show that a long portion of the tube filled with asbestus, placed beyond the substance and kept at a high temperature, could replace the oxide of copper.

Oxide of copper, therefore, or some similar re-agent, must be used in the combustion tube. Some prefer to make the mixture as in Liebig's process. Erdmann & Marchand introduce the oxide of copper alone and for two-thirds its length, into the tube, which is closed at the further end with a dense plug of copper turnings, and heat the tube, passing slowly a current of dry air, (which requires a quarter of an hour,) and let cool. The organic substance is then introduced and mixed with the oxide of copper by means of a copper wire, fashioned at the extremity like a corkscrew, and the remaining space is filled with oxide, which has just been ignited over the lamp, in a platinum crucible. The pure oxide of copper, at either end of the tube, is first heated by adding the wicks, and finally the mixture itself, passing, at the same time, a slow current of dry oxygen. The corks are not dried; but evaporation and absorption are prevented by coating them with lead foil. This is effected by placing upon the cork a small disc of foil, of a couple of lines greater diameter, and with a pointed glass rod, which fits the hole, breaking through the foil and pressing it against the inside of the cavity; the Ca, Cl tube is then carefully introduced at the other end.

Hess (in his original memoir) and Wöhler, introduce the organic substance in a little boat of platinum or glass, which enables the residue, where there is any, to be further treated.

In combustions of salts of the alkalies or alkaline earths, where the boat contains resulting carbonates, the apparatus which I have described in the May number of the last year's Journal will be found convenient for determining this carbonic acid, as it is well calculated for small quantities of substance.

In all cases, the regulation of the oxygen stream is an important point, and should be such, that when the apparatus is filled with carbonic acid, almost no gas (in case of nitrogen free bodies) passes through the potash apparatus. Cases of carelessness in this respect, Hess says, may be detected by applying a light to the end of the potash apparatus, which causes slight detonations of the mixture of oxygen with the unconsumed inflammable gases of the substance. Erdmann & Marchand employ, in addition to the oxygen gasometer, one containing air, and milk of lime instead of water, which is used for heating the oxide of copper, and for cooling, at the close of the operation, in a current of air.

For those regardless of expense, and who are disgusted with the intolerable heat of a combustion in summer, and with the ashes of the charcoal, which fill the laboratory, Hess' process is a very acceptable one. He calculates the quantity of alcohol for one combustion to vary from a little less than a *litre to one litre and a-half. Where gas may be had, it forms an advantageous substitute for alcohol. Apparatus for combus-

* Litre, two and one-tenth pints.

tions by gas have been described by Kühn Liebig's *Annalen*, lxxiv, p. 115, by *Beale Pharm. Jour. Transactions*, x. 9, by Sonnerschein, Erdmann & Marchand's *Journal*, lv, p. 478, and by *Magnus*, idem, lx, p. 52.

I have been myself engaged in perfecting an apparatus for combustions with illuminating gas, a description of which, if it stands the test of experience, will appear in some future number of the Journal.

The other modification of the Hess process, proposed by Alexander & Morfit, consists of measuring the oxygen used for the combustion and examining the gaseous products of combustion, to serve as a control for the analysis. As they have not given the results of such controlling experiments, compared with the analysis itself, it was, probably, found not to answer their expectation. The father of organic analysis, Lavoisier, first employed the method of determining the elements of an organic substance, by comparing the oxygen used in combustion with the products of combustion, and determined the composition of coal, wax, alcohol and sugar. Saussure & Prout have both described processes of the same nature. To be of any avail as a check to the analysis, the controlling process should be of at least equal accuracy with the analysis itself; and it is difficult to see how an accurate determination of the oxygen used can be obtained by the method described by Alexander & Morfit. On the perfection of the modern process of organic analysis, all such methods were generally abandoned as being (with the same degree of care) much less accurate and much more difficult to carry on with proper results.

For the Journal of the Franklin Institute.

Large Steamer.

The Fall River Steamboat Line (one of the lines between New York and Boston,) are now building the largest steamer, of her class, in the world; the following are a few of her dimensions:—

Length of keel,	325 feet.
Breadth of beam, inside of wheels,	45 "
Depth of hold,	15 "

Single engine with top lever.

Diameter of cylinder,	8 feet 9 inches.
Length of stroke,	12 "
Diameter of paddle wheels,	40 "

With four tubular boilers placed on guards.

Hull of boat by Samuel Sneden, of Green Point; engine by Stillman, Allen & Co., of New York.

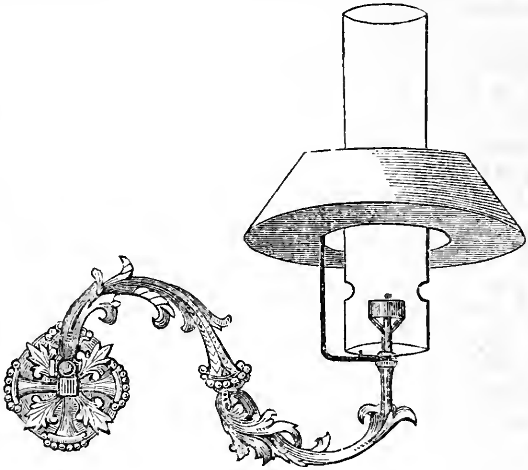
---

*Boggett and Pettit's Patent Dioptric Refractors.**

It is well known to those who are acquainted with the principles of optical science that when light passes from one medium into another in any direction not perpendicular to the surface dividing them, that direction undergoes a sudden change, called refraction. The amount of this

* From the London Mechanic's Magazine, November, 1853.

change of direction or divergence is dependent on the angle at which the light enters the refracting medium, or the angle of *incidence* as it is called. To take advantage of this principle in utilizing to the utmost extent the light derivable from gas and other burners of the description in every-day use has been what Messrs. Boggett and Pettit have proposed to themselves; and that they have succeeded admirably admits of no question. The accompanying engraving represents one of their new dioptric refractors applied to a gas burner. The instrument, it will be seen, consists of a



glass ring of a prismatic section placed so as to surround the flame at such a height that all the lateral rays of light proceeding from it are intercepted by the ring, and, falling on its inclined exterior surface, are projected downwards and concentrated within the range of the refractor. This range will depend on the angles given to the interior and exterior surfaces of the prismatic ring, and can evidently be increased or diminished by making the angles between the sides and the base of the prism greater or less. The effect produced by the arrangement is such as could not fail to excite the attention of even the most cursory observer; and we predict for the invention a long and successful run. It is not indeed under all circumstances that it is desirable so to concentrate the light; but for all show purposes, and to enable delicate mechanical or other operations to be performed with artificial light, this is absolutely necessary; and there is no contrivance by which this can be done so effectually as by the present.

Messrs. Boggett and Pettit propose also, where a lighter refractor than one composed of solid glass is required, to make hollow refractors; that is, to combine a series of prismatic rings of much smaller sectional area and of gradually decreasing diameter, in the manner of a flight of steps; the exterior inclined surface being, however, always plain and the interior one step-fashioned. This arrangement is found to produce an equally good effect.

*Ocean Steamers.**

(Continued from page 66.)

The discussion being resumed on "Ocean Steamers," it was contended that the statement of a supposed wave pressure of 85,000 tons of water, or even of 40,000 tons, to which it had since been reduced, by a modified estimate, was inadmissible; it would be manifestly impossible for any vessel to withstand such impact from a body of water; and if the position was admitted, it must be evident, that any of the ordinary coasting steamers would constantly be liable to a pressure of 1000 to 1500 tons, which would suffice to utterly destroy them.

The comparison of the qualities for safe riding, when lying-to between a line of battle ship and a privateer, was not to the point, as the former was encumbered by the enormous weight of her armament, and by her top hamper; in short, the whole misconception had arisen from confounding the wave of oscillation with that of translation; this was exemplified by the case of a disabled vessel; as long as she remained afloat she was comparatively safe, but, as soon as she touched the ground, and the wave of oscillation became one of translation, she was immediately knocked to pieces by the impact of the waves.

Next, as to the proportions of 6 to 1, which had been derived from as ancient a type as Noah's Ark—now, as far as was known, as that construction had not been designed either for sailing or steaming, but only to float with a very large cargo, it afforded no analogy for vessels built for speed, however propelled; and, in fact, modern fast sailing vessels had abandoned those proportions, which had only been perpetuated by the old tonnage laws, under which merchant vessels were enabled to be constructed to carry enormous cargoes, but they were unable to attain any considerable speed. It was further argued that, as steam propulsion was employed, the analogy became still less apparent; and, as an instance of the advantage of lengthening ships, the case of the vessels belonging to the North of Europe Steam Navigation Company was mentioned. The *City of Norwich*, 183 feet long, 26 feet beam, 471 tons burthen, and 200 horse power, could carry, as cargo, 220 head of cattle, at a speed of 10 knots per hour, but she rolled considerably with a beam sea; whilst the *Tonning*, 222 feet long, 27 feet beam, 734 tons burthen, and 200 horse power, carried 360 head of cattle, at a speed of 12 knots per hour: she was a remarkably easy vessel, and had proved her sea worthy qualities by coming safely round the coast of Scotland, during the late gale in September. Thus, with the same engine power, by merely altering the proportions from 7 to 1 to 8 to 1, nearly 60 per cent. more cargo space was obtained, and 2 knots per hour were gained in speed, with improved sea-going qualities. It must be remarked, also, that the relative proportions of the *Tonning* were almost identical with those of the proposed iron vessel for the Eastern Steam Navigation Company.

Taking the *Wave Queen* as an extreme case—her length being 213 feet with 15 feet beam, and proportions of 13 to 1, with a draft of water of only 5 feet, and comparing her performances with those of the

* From the London Artizan, January, 1854.

Christiana, a good vessel, about 170 feet long, and with about the proportion of 6 to 1—it was found that, whilst the latter, in a moderate head sea, continually shipped the waves, the former, in a similar sea, was perfectly dry. This evidence was given from the personal experience of the speaker.

The *Wave Queen* had since been running between Newhaven and Dieppe, and it was to be expected—indeed, it had been predicted—that, from local circumstances connected with the entrance of the harbor at Newhaven, she would meet with some casualty. She was not stranded in consequence of any inefficiency in the power of the rudder, but, after a very bad passage across the Channel, in the trough of the sea, which was running very high, she arrived off Newhaven when there was scarcely depth of water over the bar for her to cross; she touched the ground heavily, and hung by her "heel;" a beam sea catching her at the same moment, swung her round and threw her broadside on the beach, where all the passengers were safely landed. It was a good proof of the strength that could be given to iron ships, that, though she was thrown broadside on the shore by the waves of translation, she was safely got off and brought round to the Thames without material damage.

As to the elaborate calculations entered into, with respect to the three great navigation projects—before admitting the correctness of those results, it must be clearly understood, that the *Rattler*, which had been used as the type, was built during the most pressing period (scientifically) of construction in H. M. Dockyard. Her dimensions were 176 feet long, by 32 feet 6 inches beam—a proportion of about 5½ to 1; and, from what had been published, it must be evident, that she had just performed what might have been anticipated from such proportions. At the time of the construction of the engines of the *Rattler*, marine engineers had scarcely adopted, and rarely practised, the use of the steam at a certain amount of pressure, and expanding in the cylinder, whereby such a vast economy in the consumption of fuel is now realized. Now, if the calculations of fuel required for long voyages were based upon the old scale of consumption, instead of the present rate, which, in good ships, did not exceed 3½ pounds per *real* horse power, the deductions from the calculations must be still more unexceptionable.

It was then contended, that all arguments based upon calculations of the speed and other qualities of such type, must be utterly fallacious. It had been shown what inscrease of peed and of carrying qualities had been produced by lengthening the *Tonning* without increasing her power, and, by analogy, it was only reasonable to presume, that if the proportions of the *Rattler* had been altered from 5½ to 1 to nearly 8 to 1, there would have been a still more striking amelioration, and she would have been a more trustworthy type for the calculations and arguments as to the practicability of constructing and of commercially working large ships. It was argued that, with all these and many other examples to the contrary, it was evidently incorrect to attempt to assume that 6 to 1 was the best proportion for vessels of any kind.

It was assumed, that when it was stated a large steamer was intended to run to India or Australia, and back, without recoaling, it was only

meant that she would carry enough coal to avoid detention at the intermediate ports, as (unless it was ascertained that she could not procure a more profitable cargo) it would, evidently, be more economical to send coals to the ultimate and distant port by sailing vessels, who would convey them cheaper than she could do.

It must not be supposed, that the meeting received for granted the results of calculations based in such a type as the *Rattler*, nor that the institution could pretend to do more than offer a field for the investigation of the scientific portion of the magnificent commercial experiments about to be tried, and for the success of which all must unite in offering their best wishes. Engineers, unless especially called upon to give opinions on the prospects of commercial success offered by undertakings, were only expected to consider the best means of executing given works at the cheapest rates, compatible with security and durability, but the ultimate remuneration for the outlay must be mainly a subject for the consideration of the speculators.

The advantages of employing a smaller number of large ships, rather than a greater number of small ships, for a given trade, especially for long voyages, was beginning to be generally admitted by ship owners. A return was published in the *Times* of November 22d, 1853, copied from the *Liverpool Albion* of November 21st, which presented the results of that experience in a remarkable form.

"The following table shows the average number of days occupied on the passage by the vessels of different tonnage, ranging from 200 tons upwards, dispatched from Liverpool to Australia, in the years 1852 and 1853:—

TONNAGE.	1852. Average number of days.	1853. Average number of days.
Under 200 tons,	137	133
From 200 to 300 tons,	122	122
" 300 to 400 "	123	113
" 400 to 500 "	118	112
" 500 to 600 "	113	112
" 600 to 700 "	107	103
" 700 to 800 "	108	101
" 800 to 900 "	103	100
" 900 to 1000 "	102	95
" 1000 to 1200 "	96	91
" 1200 and upwards,	91	90

"From the above table, it will be seen that, in almost every instance, the average is in favor of the largest ships, the 600 ton ships having an advantage of 24 days, on the average, in 1852, over the 200 ton ships, and the 1200 ton ships having an advantage of 22 days over the 600 ton ships. In 1853, also, it will be seen that the results are much the same."

But even with this evidence, it would not be wise to rush to the conclusion, that vessels of enormous size would be applicable in all circumstances; in fact, that which determined the expediency of using a large ship was the coincidence of a great amount of traffic and great length of

voyage. For example, it might be questioned, except for some special branches of commerce, which appeared now about to be greatly developed, whether a very large ship would be likely to be commercially beneficial, between any two ports of Great Britain.

It must be evident that, for each length of voyage and description of trade, there was a particular size of vessel, that would be most suitable; and, indeed, as in most other engineering works, the circumstances of the traffic would of themselves mainly determine the proportions of the structure. Take, for example, the trade between England and America, as originally opened by the *Great Western;* that vessel, as first designed, although much the largest ship of her day, was of the smallest size by which such a trade could be conducted, and her length was actually increased, during her construction, to a point then generally considered dangerous.

Since that period, all vessels on that station had been successively augmented in dimensions, as the trade increased; but even those vessels were too small for the Australian voyage of 25,000 miles, and the necessity of increasing the length was shown, by calculating how much coal would require to be carried, beyond that needed for an American voyage, in order to do the Australian or the Indian voyage equally well. Such calculation demonstrated, that a vessel similar to the *Great Western* would require to be lengthened to 520 feet to accomplish that voyage. This argument showed, that the conditions of the case compelled the adoption of vessels of extraordinary length for steam voyages of extraordinary distance.

Then, as to the commercial question, the merchants engaged in the Indian and Australian trade had calculated, from the data afforded by their own business, what amount of freight and passengers would require accommodation, and it was found, that the quantity was greater than could be received by the ship just calculated. The dimensions, therefore, required to be enlarged, to meet the demand of the existing trade. Thus the traffic itself did actually fix the dimensions of the proposed large class of vessels.

As to the mechanical strength of such vessels, there was no difference of opinion on that point, among engineers, provided the structure was of iron. Ships of wood, on the contrary, were limited in size, by the nature of the material, which was *grown*, and not *manufactured*, and therefore the produce was of limited size; whereas, plates of iron could, on the other hand, be rolled of any required dimensions. It must be observed, also, that the strength of wood across the fibre was so small, that two planks could not be so united as to be equally strong in all directions, whilst two plates of iron, riveted together, were of nearly uniform strength.

Further, as to the resistance of large vessels to waves, it was evident that the waves of the Atlantic, being of the same size, whether the vessel was small or large, their proportional magnitude would be decreased as the size of the vessel was increased, so that the large ship in a gale would merely encounter waves of the same proportional size as a ship of half the dimensions in half a gale; and it should be remarked, that the largest ships which had beed proposed were only double the lineal dimensions of existing vessels.

As to the impact of waves upon ships, it should be remembered, that a vessel riding on a wave became, virtually, a part of that wave, and moved along with it, as the mass of water, displaced by its bulk, had previously moved. The large Atlantic waves observed by Dr. Scoresby did not strike the ship, but made her rise and fall in a gentle oscillation, each of which lasted 16 seconds, a period of too long duration to admit of any approximation to violent collision between bodies.

It was only the small wind-waves, or crests, which moved at a different velocity from that of the ship; and the proposed vessels were so much higher out of the water than the observed altitude of these waves, that the decks would probably never be more than wetted by the spray.

It was explained, that H. M. ship *Rattler* had been assumed as a type, or good example of locomotive efficiency, because the formula $\frac{(\mathrm{V}\sqrt[3]{\mathrm{D}^{\frac{2}{3}}})}{\text{indicated HP.}}$ gave the highest result of any steamer examined by that rule. It would be seen, that formula merely embraced the relations of velocity, displacement, and working power.

It was stated, that vessel which, from any fault of construction, or from imperfect steering power, was liable to fall into the trough of the sea, would, in that position, be liable to fearful accidents; and instances were cited of two vessels, of 800 tons and 1200 tons respectively, being struck by waves which had carried away all the upper works and swept the decks clear. These practical facts were given to show that the gentle oscillation of heavy waves must be received with some qualification. In answer to this, it was explained that, in a storm there were generally two sets of waves, the long low oscillating wave, and the smaller waves, which were much shorter, rising under the action of the wind. It was these short waves which struck the smaller vessels with so much force when they got on the crest of a large one, but the deck of a very large ship would be too high for such wind waves to break upon it except as spray.

Returns were presented of the performances of a number of paddle-wheel ocean steamers for a period of twenty-two years, tending to prove how greatly the velocity had been increased. This was shown to have arisen from the augmented size and better build of the vessels, with greater power of engines and other engineering improvements. These tables showed the necessity of a careful selection of the period from which a mean average of velocity was deduced; for example, the *Hugh Lindsay*, H. E. I. Co's. steamer, gave, in 1830, a mean average of $5\frac{1}{2}$ knots per hour; whereas, the best of the Cunard and of the Collins' lines of steamers gave a mean average of $12\frac{1}{2}$ knots per hour for the last three years.

It was explained that the average of 7.9 knots per hour had been derived from Admiralty returns, extending from 1848 to 1851, which were the only reliable documents of the kind hitherto published.—Members were urged to supply the present evident want of information on this subject.

As to the question of measurement for tonnage, after discussing the present method, describing that proposed by the parliamentary committee,

and those by the practical men who had been consulted, the system indicated by the author of the paper was examined with care, and was admitted to possess novel features worthy of consideration, in fixing a legal standard of measurement. It was, however, contended that, for scientific purposes, the displacement to the load line was required, and for fiscal purposes it was submitted, that the light and other dues would be more equitably imposed by an *ad valorem* duty on the cargo, rather than on the bulk or form of the vessel.

In winding up the discussion, the dimensions were given of a great raft ship called the *Baron of Renfrew*, which was built at Quebec in the year 1825, by the late Mr. Charles Wood, of Port Glasgow. Her extreme length was 304 feet, extreme breadth 61 feet, clear depth 34 feet, registered tonnage 5294½ tons, and cargo of timber 8500 tons. The draft of water, at the end of the voyage, when water logged, was 31 feet. She had four masts, and the sails of a 36 gun frigate. Her greatest inclination, under press of sail, was about 20 degrees. Her greatest speed, before she became water logged, but with 19 feet of water in the hold, was 8½ knots, which was reduced to 6 knots when she was quite full of water. She made the passage from Quebec to the Isle of Wight in 48 days. It was due to Mr. Charles Wood to mention this daring innovation at so early a period.

It appeared, that if the dimensions of vessels had been increased, it was evident that there had not been any increase of danger, nor was any to be anticipated. The hesitation in receiving new propositions of startling projects was very natural, and, therefore, their discussion was valuable and really useful in eliciting opinions which might otherwise probably not have been given. The feasibility of the Britannia Bridge had been quite as much doubted as that of very large iron ships, and yet it had been executed, and the result was before the world. It appeared evident that, in future, engineers must look even further forward than they had done, and, in their maritime constructions, must adopt dimensions for their docks and harbors to accommodate the increased sizes of the vessels they were destined to receive, but which some years since would have been deemed visionary.

For the Journal of the Franklin Institute.

The Mineral Contents of the Lower Magnesian Limestone of the Upper Mississippi. Condensed from Dr. Owen's Geological Survey of Wisconsin, &c. By Dr. L. Turnbull.

(Continued from page 133.)

The lower magnesian limestone, north of the Wisconsin River, has many points of analogy with the upper magnesian limestone of the Mineral Point and Dubuque districts of Wisconsin and Iowa—a rock, which has proved itself to be extraordinarily productive in lead ore, and has afforded copper ore of excellent quality, which is now smelted with profit in the vicinity of the mines, according to Dr. Owen. This lower magnesian limestone may be considered more favorably situated than the upper, as a mineral-bearing rock. It is considered an established

fact in geology, that, all other things being equal, the lower or older a rock is, the more likely it is to be metalliferous, because nearer rocks of igneous origin.

There can now be little doubt that the whole mining region of the Mineral Point and Dubuque districts of Wisconsin and Iowa is based upon a syenitic and granitic platform, which will be reached by penetrating to the depth of from two to four thousand feet. This is considered as highly favorable to the metalliferous character. The following are actual discoveries in corroboration of these facts:

Near the base of a bluff on the West side of the Mississippi River, some ten or fifteen miles above the mouth of Turkey River, and just above the French Village, from seven to ten thousand pounds of lead ore were obtained from openings in the rock. More or less galena is found here, in all the horizontal openings, for the distance of half a mile to a mile.

Near the mouth of the Kickapoo, on the South-east quarter of Section 10, Township 7, North Range 5, West of the 4th Principal Meridian, pieces of lead ore, weighing from half to three-quarters of a pound, have been obtained from cherty beds of the inferior part of the lower magnesian limestone. A company has lately commenced exploring there, and has obtained some hundred pounds of galena.

On the opposite side of the same valley, Hearn and Ward obtained about four hundred pounds of galena; some masses weighed fifteen pounds. Also, on Section 15, Township 7, North Range 5, West of the 4th Principal Meridian, lead ore has been found; also, in the hills at the first great Western bend of the Kickapoo, below the mouth of Plum Creek, half a mile South of the afore-mentioned valley, Burns and Miller procured about one hundred pounds of lead ore.

East of the 1st Locality, Hearn and Miller dug sixty feet, and followed an East and West lode, in which they obtained a small quantity of lead ore.

All these discoveries were made in the lower magnesian limestone. F. 2.

In the same vicinity, on the South half of Sections 33, 34 and 35, Township 8, North Range 5, West, there are vestiges of ancient diggings, wrought by the aborigines. Also, between Yellow River and the upper Iowa River, eight or ten miles below the Big Spring, lead ore was also discovered.

On the Wazi-oju, W. B. C. Macy, of Dr. Owen's Geological Corps, saw a vein of lead ore, of four inches in width, bearing nearly East and West, and ranging, apparently for the distance of one-half to three-quarters of a mile, through the lower magnesian limestone; also along Plum and Pine Creeks, tributaries of the Kickapoo.

A heavy lode of lead ore is said also to have been discovered on the Half Breed tract, near the Wazi-oju, by Joseph Bison. This vein is represented as being from ten inches to a foot wide, and filled with galena, embedded in the usual matrix of red tenacious clay. Also, two miles below Bad Axe River, lead ore was found attached to calcarious spar, having fallen from the cliff of the lower magnesian limestone.

In the Winnebago Reserve, not far from the Iowa River, and a few

miles North-west of the small town of Lansing, lead ore was found, in small quantities, chiefly in pockets and cavities.

The above instances abundantly prove that the lower magnesian limestone, as well as the upper, is lead-bearing; whether productively so or not, cannot be fully determined until the rock is scientifically mined. It is certain, that at many of the above localities, the rock is exceedingly cherty, and is, consequently, hard, and difficult and expensive to work, and near the surface the ore is much scattered and disseminated through the rock, rather in horizontal openings than in vertical veins; still, if this surface ore should be connected with deeper lodes, as there is some reason to believe it may be, then these would be well worthy the attention of the miner. Under present circumstances, however, and with the uncertainty attaching to the last hypothesis, Dr. Owen did not consider it his duty to recommend lead mineral reservations where this formation prevails.

Dr. Owen estimated the annual produce from the lead mines of the Mineral Point and Dubuque districts, for the year 1839, was thirty millions of pounds. The following are the total shipments for the years 1841 to 1850, inclusive, from his work, and the three additional years being added, make it complete to 1854:—

Shipments of Lead from Galena and Dubuque, and all other points of the Upper Mississippi, for the years 1841, '42, '43, '44, '45, '46, '47, '48, '49, '50, '51, '52 *and* '53.

	Pigs of lead. 1841.	Pigs of lead. 1842.	Pigs of lead. 1843.	Pigs of lead. 1844.	Pigs of lead. 1845.	Pigs of lead. 1846.	Pigs of lead. 1847.	Pigs of lead. 1848.	Pigs of lead. 1849.	Pigs of lead. 1850.	Pigs of lead. 1851.	Pigs of lead. 1852.	Pigs of lead. 1853.
Total.	452,814	447,859	561,321	624,601	778,460	730,714	771,679	680,245	628,934	569,521	474,165	391,582	425,635

As a pig of lead will weigh, on an average, seventy pounds, it appears from the above table, that the annual produce has varied, in the last ten years, from nearly thirty-one millions to upwards of fifty-four millions of pounds.

The decrease in the production of 1848, 1849 and 1850 is, in part, attributable to the number of volunteers in the Mexican war, and in part to emigration to the gold mines of California.

"During the greater part of the season of 1852, extreme low water has been a serious interruption to navigation. The delay and difficulty experienced between Dubuque and St. Louis have been so great that the ruling prices of freight have had the effect to keep back many thousands of pigs that would, under other circumstances, have been carried out. Again, the river virtually closed three weeks earlier than in 1851. In 1851, the last shipment was made on December 3d, and this year, though a much larger quantity was piled up on the levee than usual for the season, the last sent forward was on November 16—a difference of three weeks, covering a period when the lead trade is ordinarily the most active.

Immediately preceding the close of navigation, the roads between this point and the country furnaces were so nearly impassable that but little was received at the various places of shipment. The early closing of the river, the low water during the whole season, and the bad roads, will account for the apparent falling off in the amount produced in 1852 when compared with the shipments of 1851. The deficit shown by the

figures is 82,583 pigs. This, without the explanation we have given, might prove a discouraging item."—*Gal. Jeffersonian.*

The true cause of the great decrease has been the result of the tariff of 1846. Since it begun to take effect, the quantity of lead has steadily declined, until it has become even less than that in 1842. (L. T.)

Iron Ore in the Carboniferous Limestone and Coal Measure of Iowa.—Not far from Dam No. 26, and near the line between Sections 10 and 11, Township 77 North, Range 22 West, there are, probably, one or more beds of coal. Within three or four feet of the top of the shale, *i. e*, at a height of forty or forty-five feet from the Des Moines River, there is, at this locality, a band of ironstone having a specific gravity of 3·45, associated with some sulphuret of zinc, the joints being coated with a crust of selicate of alumina.

The following analysis, by the humid method, gives as follows:—

Bituminous or carbonaceous matter,	01·0
Insoluble earthy matter,	07·6
Carbonate of the protoxide of iron,	65·0
Carbonate of lime,	07·2
Carbonate of magnesia,	10·0
Alumina,	01·8
Peroxide of iron,	04·8
Phosphate of iron,	02·6
	100·0

After pounding and sifting the raw ore, a quantity weighing 1225 grains was roasted and exposed to a red heat in a shallow vessel; after roasting it weighed 865 grains; loss by roasting 360 grains, being equal to 29·4 per cent.

The color, after roasting, was a purple-brown. An assay was then made, in a black lead crucible, at a high temperature, with the following ingredients in the proportion of

Roasted ore,	865 grains.
Bottle glass,	865 "
Chalk,	865 "
Charcoal,	134 "

There resulted therefrom a button of light gray iron, weighing 377 grains, equal to 43·5 per cent. of the roasted ore, and 31 per cent. of the raw ore, differing only 2.5 per cent. from the per centage of metallic iron by the humid method. It appears from the above analysis, that this ironstone is very analogous in its composition to the ore known in Scotland as "Mushet's Black Band," the chief difference being a smaller per centage of carbonaceous matter, and the substitution of phosphorus for sulphur. It is more than probable that a repetition of the analysis of the "Scotch Black Band" would give, also, a small per centage of phosphorus, since Dr. Owen only succeeded in detecting and estimating this element in the Des Moines ore by methods which have been introduced into analytical chemistry within the last few years.

The existence of phosphorus in this ore is not a matter of merely scientific interest, but of practical importance also. Collier and Rinman assert that the "cold-short" property of iron (that is, its liability to become brittle when cold,) is due to the presence of the phosphoret;

while Mushet, whose knowledge of iron and its properties is, probably, superior to that of any other writer, doubts the assertion.

It has, he says, been matter of common remark, that iron of the most perfect quality, as the Swedish, gives out, in working, a strong phosphoric smell; and he adds, that any iron can be made cold-short by introducing into the blast-furnace, through the medium of the flues or otherwise, silica in excess.

In support of this view, he remarks, in his work on iron and steel—"The flue cinder of the balling furnace, which on an average contains thirty per cent. of silica, and the flue furnace cinder of the puddling furnace contains forty per cent., while sand bottoms were in use, furnished striking illustrations of that fact. At first, when these cinders, containing from forty to fifty-two per cent. of iron, were returned to be smelted for the production of forge pigs, the brittleness of the iron was so much increased that fears were entertained as to the practicability of their use, and maintaining a marketable quality of iron. The change of system which took place, from puddling on sand to puddling on iron bottoms, by introducing a less quantity of silica into the blast furnace, had a great tendency to reduce this evil, and restore fibre to the bar-iron."

And he concludes by saying—"From this fact being so clearly ascertained, we obtain a clue to explain the probable cause of cold-short in iron generally, by attributing it to a predominant quantity of silica in the ore, rather than to the existence of phosphorus."

Here is a marked difference between the opinion of so experienced a man as Mushet and the statement of Renman, made in the summer of 1849, to the British Association, at their annual meeting: the statement, namely, that in every instance in which Swedish iron has proved cold-short, he had been able to detect the presence of phosphorus. To this important subject Dr. Owen invites the attention of American chemists and iron masters. It is only by careful chemical analysis, conducted after the most approved method, that this moot point can be finally determined. Should phosphorus invariably be found in cold-short iron, while it should prove to be uniformly absent in iron free from that defect, the inference will be a fair one, that phosphorus is the producing cause.

To be Continued.

For the Journal of the Franklin Institute.

United States Steamers.

The year 1853 has proved a very disastrous one to our Steam Navy; one steamer, the *Alleghany*, in her first engagement with the enemy (wind and tide and fair weather) was completely disabled, after an expenditure of $150,000 for repairs and alterations, and has since been condemned as unfit for service. Another, the *Princeton*, after having been in the hands of the machinists for two years, was finally put in commission last spring, and after several feeble efforts, succeeded in reaching the fishing banks, stopping at several ports by the way, and furnishing the daily press with a variety of articles, as to her unfitness for service, &c. After an absence of a few weeks, she returned, and has again been put in the hands of the doctors; but this time a change has been made in the practice, and

there is some hope for the better, although but little can be expected where the patient has suffered so badly from malpractice. The *San Jacinto* has returned from a foreign station with a bad name, and one engine broken, and her machinery (boilers excepted); has been condemned and removed from the ship, and a contract has been made by the Secretary of the Navy with Merrick & Sons, of this City, for new engines, the terms of the contract being that they are to furnish their own plans and to guarantee the work, and as security that they will fulfil their contract they are not to receive any money on account of contract, until the machinery is approved and accepted by the Department, when one-half of the contract price is to be paid, and at the end of six months' successful steaming the balance, any defects within that time to be made good by the contractors. In departing from the usage of the Department, the Secretary has made a bold stand for the right, and if I am not mistaken, the results will show that *good* machinery can be furnished and warranted at very much less than has usually been paid for a bad article. The following report made to Congress on the subject will be of interest to the readers of the Journal. FULTON.

Letter from the Secretary of the Navy, transmitting Report of a Board of Engineers as to the causes of failure of certain steamers of the United States Navy.

December 21, 1853.—Ordered to be printed.

NAV. DEPART., *Dec.* 19, 1853.

SIR: Agreeably to your verbal request, I have the honor to transmit herewith copies of the instructions to, and reports of, the officers ordered to examine into the causes of the recent failures of the Alleghany, Princeton, and San Jacinto.

I am, very respectfully, your obedient servant,

J. C. DOBBIN.

HON. THOMAS S. BOCOCK,

Chair. of Comm. on Naval Affairs, House of Rep.

NAV. DEPART., *Oct.* 27, 1853.

SIR: I have appointed a board of engineers to make certain examinations of the machinery of the Alleghany.

Having confidence in your judgment and skill as a naval constructor, the department desires you to examine the hull of the ship, and report—

1st. Whether, in your judgment, she will answer for a war steamer.

2d. If any weakness or inefficiency of the hull could, in your judgment, have been the cause of the recent disaster to the machinery.

You will report your views to the department.

It is desirable that you should be present when the board of engineers visit the ship, and give them such information touching the hull as they may wish.

I am, respectfully, your obedient servant,

J. C. DOBBIN,

JOHN LENTHALL, Esq.,

Chf. Nav. Constr., Bureau of Construction, Equipment, and Repair.

WASHINGTON, *Oct.* 28, 1853.

SIR: In compliance with your order of yesterday, I have examined the hull of the "Alleghany."

Upon the subject of your first inquiry, I would respectfully state that the hull of a ship of war similar to the "Alleghany," if built of timber in the usual manner, would weigh about 638 tons. From an examination of the bills for the original construction of this vessel, I find there were 334 tons of iron charged for the hull. A portion of this was removed during the last repair at Norfolk; but as additional iron timbers were put below the berth-deck, for a length of forty-five feet amidships, the weight of the materials of the hull will remain nearly the same—that is, it is only about one-half that of a similar ship-of-war built of timber. In general terms, the strength may be taken in proportion to the weight of materials; and that this ship is weak, may be shown by the number of timbers that were broken during her first cruise, and the additional iron braces with which it was necessary to secure her. The short timbers that were put in at Norfolk have added very little to her strength. The shape of this ship is such as has in all other cases been found to cause much strain and uneasiness of motion. This, together with the great deficiency in the quantity of materials, and consequently of strength, in my view, renders her unfit for a war steamer; nor do I consider her form as advantageously adapted to a steam propeller.

Upon the subject of the second inquiry, I would state that I do not consider that the recent disaster to the machinery should be attributed to the weakness of the hull, for that has been pointed out since the 5th of July, 1850, as stated in an official report of that date.

All ships are subject to a change of shape in their rolling and pitching motions, and engineers avoid connecting any of the delicate moving parts of their machinery with them, as it would cause the engines to work their own destruction. But in this ship, when the great mass of machinery, the magnitude of the parts, and the manner in which they are connected together, are taken into consideration, it is a matter of surprise that its enormous power has not shaken so frail a hull to pieces, which in a rough sea might have been the result.

I have the honor to be, sir, with the highest respect,

Your obedient servant,

JOHN LENTHALL.

Hon. J. C. DOBBIN, *Sec'y. of the Nav.*

NAV. DEPART., *Oct.* 27, 1853.

GENTLEMEN: Public attention has been attracted to the unfortunate failures which have recently occurred in the several steamers of the navy. The inefficiency of the Princeton, the Alleghany, and the San Jacinto, particularly after the expenditure of large amounts of money, renders it the duty of the department to institute searching investigation, not only as to the causes of those repeated disasters, but as to the officers or individuals who are responsible. The service suffers in reputation; money is expended liberally, producing results only requiring further

outlay; the interests of the government are subjected to inconvenience, and perhaps hazard.

Having confidence in your judgment, skill, and integrity, the department desires you to report, after due examination—

1. The causes of the failure of the San Jacinto, the Princeton, and the Alleghany.
2. Who advised or designed the machinery for them.
3. Whether the boilers in the Princeton and Alleghany are upon a different principle from those in our war steamers which are doing well.
4. Whether that plan of boilers had been ever before tried in this country, and at whose instance they were introduced or modified.

The records of the department can be examined, if desired, to facilitate your investigations.

I am, respectfully, your obedient servant,

J. C. Dobbin.

Daniel B. Martin, Esq., *Eng. in Chf., U. S. N.*
Henry Hunt, Esq., *Chf. Eng., U. S. N.*
Charles W. Copeland, Esq.

P. S.—You will, in your report, state whether the Lamb & Summer boiler was adopted for the Princeton and Alleghany, and why; also the reason for its alteration to the present form of boiler.

J. C. D.

Washington, *Oct.* 28, 1853.

Sir: We have the honor to acknowledge the receipt of your order of the 27th instant, and, in compliance with one portion thereof, we have visited the steamer Alleghany—yesterday, and again to day—for the purpose of examining the engines and boilers, and would respectfully submit the following brief preliminary report upon that vessel:

Without, at this time, entering into details, and the reasons why, but reserving that for a future report, we would simply state—

1st. The engine frames are badly broken, and they cannot be repaired and the engines properly modified, without taking a large portion of them out of the vessel, and incurring considerable expense and loss of time.

2d. The boilers are quite inadequate to supplying the engines with the requisite amount of steam.

3d. The hull of the vessel has not sufficient strength for engines of so great power.

4th. In our opinion, the model of the vessel is entirely unsuited to the application of the screw propeller.

We would, therefore, respectfully recommend that no more money be expended upon that vessel to fit her for the purpose of a naval steamer.

We remain, very respectfully, &c.,

Danl. B. Martin, *Eng. in Chf.*
H. Hunt, *Chf. Eng.*
Chas. W. Copeland.

Hon. J. C. Dobbin, *Sec'y. of the Nav.*

WASHINGTON, *Nov.* 19, 1853.

SIR: As a final report in reply to your letter of the 27th ultimo, (a preliminary one having been already presented,) we have the honor to submit the following:

To your first inquiry, viz: "The causes of the failure of the San Jacinto, the Princeton, and the Alleghany."

In regard to the San Jacinto, we conceive the principal causes to be—

1st. A very improper, injudicious, and in every way inferior arrangement of the engines for the purposes of their application, both in its general plans and details. In the general plan, the great defect was such arrangement as that almost the whole power of the forward engine was transferred from one end only of the cross-head: as the result, the breaking of the piston rod has occurred. Another objectionable feature is, that they are very unequally balanced, thereby involving very great irregularity in their motion.

The whole arrangement of the details was very complicated, which is highly objectionable in engines which are to run at a high velocity. The arrangement of details was also defective, in that it was almost impossible to adjust any part when in operation; also, that in case of necessity to make repairs, it involved the taking apart of much of the engines.

Many parts of the engines are badly proportioned, the frames particularly being shown, from the time engines were first put in operation, to be entirely too light.

There is also an objectionable feature in the location of the propeller on one side of the centre line of the ship, requiring a constant counteraction of the rudder, and causing the vessel to work badly when under sail.

The boilers we believe to have operated well in every respect, with the exception of some leaks in the centre boiler, the consequence of an injury received when landing on the wharf at New York.

In regard to the Princeton:

The principal cause of the failure of this vessel we conceive to be in the plan and arrangement of the boilers, the consumption of fuel being very great in proportion to the result obtained.

As to the engines, we are of the opinion that the substituting a "Sickel's cut-off," as then arranged, in a very complicated manner, with a puppet valve, for the original slide valve cut-off, to have been a very injudicious alteration to these engines; in fact, all the important alterations of the engines from the original arrangement have been highly injudicious.

The propeller is not such as we would approve, but yet we have no doubt its operation would have been comparatively satisfactory had the engines and boilers been efficient.

In regard to the Alleghany:

With respect to the boilers, the same defects exist as in those of the Princeton, with the additional one of their being quite too small to supply the requisite steam to the engines.

The arrangement of the engines we think too complicated, and not sufficient provision is made for adjustment and attendance. We are also of the opinion that the workmanship and arrangement of details are quite inferior, and that the engines are not erected in the ship in a proper and substantial manner; on the contrary, they reflect discredit upon all who had to do with their design, arrangement, or construction.

The breaking of the frames has resulted from two causes, viz: the weakness of the ship, and the want of a proper foundation under them. We also think the designer of the engine frames censurable for not providing, in the design and strength of the frames, for the *known* weakness of the ship's bottom, and the want of a proper foundation. We consider the ship entirely unsuited for the purposes of a naval steamer, both in strength and model. That the hull is very weak, may be determined by simple inspection; but more than this, it had already been proved most satisfactorily to be the case, by experience, previous to placing the present engines on board. Although the ship was strengthened, as recommended by Mr. Stuart, late engineer in chief, it was done in such a manner as to add in no degree to the strength of the bottom.

The model we also believe to be of the most objectionable form that could be devised for the application of the screw propeller, or for the carrying of an armament; and we are confident in the opinion, that, had the operation of the engines and boilers been all that could be desired, no satisfactory speed would have been attained by the vessel. And we can only express our utter astonishment that so great expense should ever have been recommended upon *such* a hull for a war steamer, or that, when recommended, it should have been approved.

In reply to the second question, viz: "Who advised or designed the machinery for them?"

First. Of the "San Jacinto," we find by reference to records in the Navy Department, that, so far as relates to the location of the propeller, shaft, and rudder, relatively, these points were decided upon by a board convened March 23, 1847, for the purpose of fixing upon dimensions, power, and general arrangements of four steamers, which had been authorized by an act of Congress. Therefore, so far as these points may have affected the efficiency of the vessel, this board is responsible.

We conceive that they are also responsible in having adopted a general plan of engines submitted by Mr. Haswell and Mr. Faron; but as the original plan has been destroyed, we cannot say that the plan upon which they were *actually* constructed was the same—in fact, there is strong evidence to the contrary.

It also appears by the record, that this board approved of double puppet valves being used, and also decided upon the use of the "Sickels" cut-off; the same being advocated by the engineers whose general plan of engines was adopted. It also appears by the record, that Mr. Haswell, the former engineer in chief, in conjunction with Mr. Faron, presented and advocated the plan of engine which was approved by the board. The plan was strongly opposed by Mr. Copeland during the first day it was before the board; but, on the second day, he appears to have withdrawn his objections, and it was adopted.

From all the information we have gathered, we feel justified in saying

that the engines as executed, both in their general plan and details, were either the work of Mr. Haswell or approved by him. This is not only admitted, but *claimed* by Mr. H., in many of his letters up to the time when it became evident that many difficulties would be encountered and the result unsatisfactory. Indeed, this is placed beyond dispute, up to November, 1850; as, in a letter from Mr. Stuart to the bureau, of June 21st, 1851, he asserts that Mr. Haswell claims them distinctly as "original with him," and the "children of his own brain."

Under date of January 20, 1849, he (Mr. H.) says: "The San Jacinto is to have a screw propeller, the *design* for the construction of which, however, is *not yet made*." Also, by a report of his to the bureau, dated September 28, 1849, he says: "Of the engines, (San Jacinto's,) they were designed in this office, and in their arrangements the rights of no individual have been invaded."

Immediately upon Charles B. Stuart, Esq., being appointed engineer in chief, his attention appears to have been called to the difficulties and apprehensions in regard to these engines; as he, under the date of December 31, 1850, reports these apprehensions to the bureau, and requests that a board of engineers may be ordered to examine and report upon the state of matters. A board was appointed, composed of Messrs. Williamson, Sewell, and Hunt. These gentlemen reported only upon the propeller and rudder, recommending a modification of the same, to overcome certain difficulties. These recommendations of the board were, without doubt, judicious at that time. No alterations to engines were suggested: indeed, they were probably too far advanced, at this time, to permit an alteration that would prove effective.

As to the Princeton:

Originally all the plans of the Princeton, together with the Lamb & Summer boilers, were presented and recommended by Mr. Stuart, engineer in chief. After the failure of the boilers, it appears that a board was ordered to examine and report what alteration should be made. This board were Messrs. Williamson, Sewell, Isherwood, and Ellis. They examined, and reported in favor of making a double tier of furnaces and a horizontal division of the flues, but no other alteration in the plan of the flues was recommended.

The opinion of the board was adopted in regard to the furnaces, and, by the recommendation of Messrs. Murray and Hazlehurst, and of Mr. Isherwood, as appears by his letter claiming it, the further alteration was made of substituting tubes for the Lamb & Summer flues. This entire alteration, though not rendering the boilers as efficient as was anticipated, was a very great improvement upon the previous arrangement. We have, therefore, no hesitation in saying, that whoever may have suggested the plan and arrangement of the whole previous to the alteration of the boilers, Mr. Stuart is the responsible party; as, in a letter dated July 22, 1851, he says, expressly, that the plans for the alterations of the Alleghany and Princeton are so far approved by him as to prevent any delay in their completion.

In reference to the "Alleghany:" This vessel was altered to a screw propeller at the suggestion of Mr. Stuart. All that we have already stated in regard to the Lamb & Summer boilers in the "Princeton" being

recommended by Mr. Stuart, is also substantially true of this vessel, although we find by some of the correspondence that the credit of the design is claimed by Mr. Isherwood.

It is also clear, by his own letter, that the alterations of this vessel were approved by Mr. Stuart. It appears, however, that the carrying out of the alterations was mainly intrusted to Mr. Isherwood, as we find frequently orders for Mr. I. to instruct Mr. Williamson, the engineer in charge, in regard to the execution of the work. We deem it proper to state that on both the "Princeton" and "Alleghany," although the responsibility is expressly assumed by Mr. Stuart, it appears very clear, from the drawings and record, that the preparing all the plans and directing the execution of the work was placed in the hands of Mr. Isherwood, and that he visited the works of the contractors for that purpose from time to time, by order of the Bureau of Construction.

In answer to the third inquiry, viz: "Whether the boilers in the 'Princeton' and 'Alleghany' are upon a different principle from those in our war steamers which are doing well?"—

We would reply, that the original "Lamb & Summer" boilers were unlike any boilers previously used in this country, though introduced very successfully into steamers in England; and we have no reason to doubt of their success in these vessels, had not the approved arrangement and proportions adopted by Messrs. Lamb & Summer been departed from in a very extraordinary degree.

As now altered, they are still different in their arrangements from any other boilers that we are acquainted with, although the principle of their construction is similar to that of many other boilers in use.

Query fourth, of your letter, is already fully answered in the foregoing part of this report.

With respect to the Lamb & Summer boilers, as noticed in the postscript to your letter, we would observe that, from the best information we can obtain, they were adopted for the "Princeton" and "Alleghany" upon the recommendation of Mr. Stuart, former engineer in chief, and Mr. Isherwood. *Why* they recommended them we cannot say, other than what appears upon the record; which they state to be, that they would weigh less and occupy less room, and be more efficient than ordinary flue boilers.

We find also that a patent fee of 45 cents per superficial foot of heating surface of these boilers was paid to J. J. Greenough, Esq., attorney for the patentees; and we further find, in reference to the records of the Patent Office, that the patent was taken out in this country by William Sewell, Jr., late a chief engineer in the navy.

Having thus, as we believe, replied fully to all the queries propounded in your letter of the 27th ultimo, the same is hereby respectfully submitted.

Your obedient servants,

Daniel B. Martin, *Eng. in Chf.*
H. Hunt, *Chf. Eng.*
Chas. W. Copeland.

Hon. James C. Dobbin, *Sec'y. of the Nav.*

For the Journal of the Franklin Institute.

Proportions of Locomotive Boilers. By Zerah Colburn.

I propose to discuss, in this paper, some of the proportions of the greatest influence in the production of steam in locomotive boilers. I shall endeavor to do so in the plainest manner, so that my deductions, if they should be founded on a correct conception, may be available to the operative as well as the theorist.

The objects sought in the construction of any boiler, of a given size and weight, are the generation and economical absorption of the greatest amount of heat. The first of these operations is made in the furnace; the second in both the furnace and tubes.

As the ordinary *form* of locomotive boiler is found to be of the most efficiency in these operations, I shall discuss, as I have already said, only the *proportions* of the locomotive boiler, and shall suggest no essentially different form or mode of construction.

The requisites for a boiler furnace are capacity for fuel, admission of air, water contact, escape of gases, and provision, of course, for firing. The first involves the amount and relation of length, width, and depth of furnace; the second, the gross area and air-opening of grate; the third, the "water spaces" around furnace; the fourth, the openings into tubes, and the last is had by the door.

The capacity and relative dimensions of furnace, grate area, air opening, and tube opening are the principal fire-box details which are influential in the generation of heat. All of these dimensions are deducible more from experiment than from theoretical inquiry. In discussing their extent and mutual relation, however, there are considerations which, if allowed for, will determine many of the general principles upon which they are based.

The capacity of furnace must be such as to contain, without choking the ends of the tubes, sufficient fuel for the necessary rate of combustion, and without the necessity of constant firing. The grate air-opening must admit sufficient air for the given rate of combustion, and as this air is expanded to six or seven-fold volume before leaving the furnace, the exit openings must be of ample dimensions.

The capacity of furnace is governed materially by the amount of carbon, proportionate to the whole amount, in bulk, of fuel burnt. Coke is nearly all carbon; wood contains but a small proportion, say from one-fourth to one-third. As carbon is the true heating element, the capacity of furnaces should be, other things being equal, inversely as the quantity of carbon in a given bulk of fuel.

Again, the admission of air is distributed over nearly the entire bottom of the furnace. The escape of air is made from but one end of the furnace.

The transition from these general principles is easy. The capacity of the furnace has been increased, in modern locomotives, more by an increase of length than of either of its other dimensions. This was done because the space between the driving wheels was limited, and that a portion of this space was required for the framing and springs of the

engine. For a gauge of 4 feet 8½ inches, the distance between the driving wheels, transversely across the engine, is 4 feet 5½ inches. Many engines have been built, where the width of frame and springs would give a grate of but 35 inches width, while in other cases, by a different arrangement of framing, this width has been made 44 inches.

Now, I wish to maintain the general principle, that *width* of furnace is more influential in producing rapid combustion than *length*. The reasons may be briefly stated as these:—The air passes through the fuel for the distance in which the latter lies in the furnace. A number of diagonal lines might be drawn from the centre of tube openings to successive points in the length of the grate, which will essentially represent the general distance traversed. From the fact, however, that the surface of the fuel generally inclines towards the tubes, *increase* of distance is greater with each successive horizontal approach to the back side of the furnace. Often, too, the grate inclines *from* the fire, by which the difference of distance is rendered still greater, according as the entrance of air is made towards the back side of the furnace.

Now, in proportion to the distance traversed is the superficial resistance of the fuel to the passage of air increased. It must be, at least, in this proportion, while the impact or "momentum" of the air would be of some more advantage with a thin fire than with a deep one. Again, were the distance traversed among the fuel, by the air, the same, the effect of the draft would be exhibited more strongly upon these contents of the furnace *nearest* the source of the action of the draft. And the ascent of air, answering to the demands of the draft at the tube mouths, would *supplant* the air, so to speak, that might otherwise enter the tubes from the rear of the furnace.

From these combined circumstances the intensity of the draft is inversely to the distance of the place of entrance from the place of escape of the air, but not in the same ratio. It may not be an unfair estimate to consider the intensity of the draft diminished three-fourths when the distance traversed by the air is doubled by horizontal removal of the place of air admission from the tube sheet.

It is in consequence of the greater intensity of the draft at the forward end of the grate that, to prevent the insulation of the lower part of the tube sheet by unheated air, the "dead plate" is used to exclude the air at that point. The "dead plate" is merely a closed bottom of the furnace, or "blank grate," and is now much used to promote economy of fuel in wood-burning engines, while it is claimed as an essential feature of Mr. Milholland's coal-burning boiler.

The "dead plate," however, robs the grate, as the space above this plate receives no direct supply of air; serving for no other purpose than to hold an amount of fuel which would be just as well held by an increase of the depth of the furnace. Now, as that portion of the furnace above the mouths of the bottom tubes cannot be filled with fuel without liability of "choking" the mouths of the tubes, whereby the production of carbonic oxide is caused, much of the heat is wasted, and the steam pressure falls below the working point, it would appear that there could be no loss of room available for fuel, or of the useful capacity of the furnace, by projecting the tube sheet inwards and towards the door. It would

add a little, say $10 worth of labor, to the expense of making the boiler, but it would, doubtless, save that trifling sum in a short time, by a more economical consumption of fuel. The supply of air would be increased by permitting the use of the entire area of grate, while the passage of unheated air would be *from* and not *upon* the front sheet; and, what is of nearly equal importance, the contents of the back portion of the furnace would be brought nearer the action of the draft. With a projecting tube sheet there would be less liability of covering the mouths of the tubes.

There is another important object to be secured by widening the furnace to the greatest limits allowed by a common gauge. With a boiler of the largest size which can be got between the wheels, and such as are becoming general standards for heavy express engines, it becomes necessary to increase the width of fire-box above the frame, to obtain room for a sufficient number of tubes. The water spaces, for the same reason, are made as thin as possible, and the ascent of steam is, therefore, retarded, the tendency being to diminish rather than increase the width of water space towards the top of the furnace. Under the combined contraction of the water spaces, and their curved, instead of straight, upward direction, they do not prove as serviceable as they should in the production of steam, and they do not so fully prevent overheating. The width of the water spaces, next to that of the furnace, is among the most important dimensions of the boiler.

In proportion as width is substituted for length of furnace, the ash pan may be diminished in depth, and room obtained for some increase of depth of furnace. The damper, also, becomes more sensitive to the admission of air, and can be regulated with more economy in its operation on the draft.

The relation of length to width in some of our modern wood-burning locomotive furnaces is as $1\frac{1}{2}$ to 1. With many of Stephenson's earlier engines, the proportion was as about $\frac{1}{2}$ to 1.

Keeping in view the requisite of mixing the greatest quantity of carbon and oxygen, in a given time, and with a given weight and size of boiler, we must remember, that while the former element is supplied by *hand*, the latter is only supplied by means which impose, at the best, a sensible load upon the working of the engine. Inasmuch, however, as a natural admission and escape of air is maintained, is this resistance reduced. If we find that the resistance to the admission of air is reduced by substituting width for length of grate, by so much, we may know, will be reduced the power of draft necessary to overcome this resistance, or, with a given draft, by so much will combustion, otherwise evaporation, or otherwise *power*, be increased.

The next important element in the proportions of the furnace is the opening of the tube mouths, or of the thimbles which tighten them in their places. From an internal diameter of 2 inches this opening has been reduced to $1\frac{1}{8}$ inch, the former size being that allowed in Stephenson's early engines, and the latter having been adopted in some of the heaviest engines built by Rogers, Ketchum & Grosvenor. This contraction attends the reduction in the diameter of the tubes, made for the purpose of obtaining greater heating surface, and is partly due to the increased thickness of thimbles of cast iron, as compared with wrought

iron, or as, in earlier times, none at all. If the greatest extent of absorbent surface was not an object with a given size of boiler, it would be better if the opening for the escape of heated air were in one large flue.

The processes of combustion and of evaporation are, in some respects, alike; and it is believed that the resemblance may be recognised sufficiently to perceive the importance of rapid draft. In combustion, the elements are carbon and oxygen; in evaporation, commonly speaking, the elements are heat and water. In each case, one of the elements is a palpable physical substance, the other an invisible gas. The want of either wood or water would, of course, suspend one or both of the operations. If steam is rapidly worked from a boiler, the rate of evaporation is increased. If the steam pipe be throttled, however, the pressure will rise but slowly, and the rate of evaporation will be diminished. Now, the comparison in the process of combustion is this:—If the carbon of the fuel be thoroughly and rapidly oxydized, or, what is the same, if the *products* of combustion were rapidly carried off, whether imparted to the water or wasted, and room be as quickly made for more, a larger *amount* of heat would be generated. If the tube openings, however, by their undue contraction, throttled the draft, the presence of the products of combustion within the furnace would retard the oxydation of more carbon. In the case of evaporation, the accumulated pressure of steam above the water level would be a mechanical obstacle to further production, while in combustion the accumulated products would exert a chemical preventive to further oxydation.

Especially is an increase of diameter of tubes required where these, from any cause, are extended to an unusual length. The friction surface being increased by lengthening the tube, as well as increasing the amount of air to be forced out, or the back pressure, the tube should be enlarged in diameter, to take up sufficient heated air to insure a rapid draft.

With any ordinary contraction tubes, it is possible to get a sufficiently rapid rate of combustion by narrowing the blast pipes; but this imposes a direct load upon the working of the engine.

The effect of contracted tubes may be readily inferred. Rapid evaporation can be had only by a rapid communication of heat to all parts of the water. The small tube, under an ordinary draft, takes up a quantity of heat which becomes quickly absorbed, to an extent that reduces the escaping gases to a temperature below any heating efficiency. The result is the same as if a large portion of the "heating surface" were taken away. Sufficient heat does not reach the forward portion of the tube surface to impart any elevation of temperature to the water already under the action of the first portion of the tubes. The forward ends of the tubes are, therefore, of little value, and might nearly as well be dispensed with; while, simply, by furnishing the required heat, they could be readily brought into effective use. To supply an abundance of steam of a high pressure, a great amount of heat must necessarily be applied, and some heat must be wasted; but, in proportion to the intensity of the fire in the furnace, the less is the *relative* loss. Hence, small grates, under a good draft, are most economical in their consumption of fuel. The available or useful heating quality of any temperature is the difference between it and that of the object to be heated; and this is the reason

why there is greater economy in a rapid draft and intense fire. To maintain such fires, however, without injuring the boiler, either thin iron of the best quality must be used, or else the best description of copper. The water spaces must also be wide, and the sheets incline outwards from the space on each side in approaching the top.

It is not unworthy of the subject to compare the early engines, built by Stephenson and other cotemporary builders, with those of the present day. Besides the great difference in the relative proportions of furnaces, already noticed, the tube opening was one-fifth of the entire grate area, where it is now from but one-tenth to one-fifteenth. The tubes were three and a-half times the length of the furnace, while now the distance is from two and a-half to three times. The little boilers of former times were notorious for their steaming powers. For a given capacity of cylinder, it is true that they had slightly more boiler capacity and heating surface than is now given, but they had the countervailing disadvantage of the want of expansive gear. Many of our present heavy express engines, with nearly an equal proportion of heating surface to a given capacity of cylinder, are, with the most perfect expansive apparatus, well known to be short of steam.

The practical means of widening the furnace, within certain limits, are the use of the thin edge frame on the sides of the fire-box, and such suspension of the springs as will not interfere between the wheels and furnace. The spring of the back driving axle will, probably, require to be hung transversely across the engine; with which arrangement, the equalizing levers can be kept much as at present. The trailing wheels of English engines have their springs hung across the engine, to permit of the use of the thin frame. I look upon 43 inches as the greatest width of furnace attainable within the narrow gauge and with inside framing.

To obtain greater width of tube opening, the best means are in the use of iron tubes, of the best quality, and the entire omission of thimbles. The coal engines built by Winans and by Baldwin, having tubes and furnaces entirely of iron, furnished in Philadelphia, are found to stand the severe action of anthracite, and when well set give no trouble in respect to caking. The coal-burning engines built by Winans have $2\frac{1}{2}$ inch tubes for 14 feet length.

Another means of improving the working of locomotive boilers, is in forming a better connexion of the tubes and chimney than is afforded by the ordinary "smoke box." The direction of this passage must be eased, and its contents reduced to the smallest practicable extent. The use to which the upper part of the smoke box is generally placed, has prevented the separation of that part from the general contents of this chamber. The steam pipes and throttle box, for the want of a better situation, have been placed here, and often in such a manner as to stand in the way of the draft. A plan, which I proposed some time since, for the relief of the draft of engines, on a line having low bridges, which plan, I have lately learned, was tried, with good results, some years since, on the Columbia road, but for some reason was not continued in use, was to place a level sheet of iron across the smoke box, just above the upper row of tubes. This would reduce the contents of the smoke box, and, conse-

quently, the amount of air to be lifted out. It would allow of extending the chimney downwards, and of thereby increasing its effective length, and, also, of lowering the blast pipes, and substituting blast pressure for blast suction. I look to this plan as one likely to become generally applied.

For the Journal of the Franklin Institute.

Particulars of the Steamer Tennessee.

Baltimore.—Hull built by John A. Robb, Baltimore. Machinery by Charles Reeder, Jun., Baltimore. Intended service, Baltimore and Charleston.

HULL.—	
Length on deck,	210 feet.
Breadth of beam at midship section,	33 " 11 inches.
Depth of hold,	19 "
Length of engine and boiler space,	55 "
Floor timbers at throats, moulded,	13½ "
" " sided,	8 "
Distance of frames apart at centres,	26 "
Coal Bunkers—Iron.	
Capacity of coal bunkers in tons of coal,	150.
Masts and rig—Two masts, foremast square rigged.	
Tonnage,	1149.
ENGINE—One—Vertical beam.	
Diameter of cylinder,	72 inches.
Length of stroke,	9 feet.
Weight of engine,	238,200 pounds.
BOILERS—Two, double return flued.	
Length of boilers,	18 feet.
Breadth "	11 " 6 inches.
Height " exclusive of steam chimney,	12 "
Number of furnaces,	3 in each.
Length of grate bars,	6 " 4 "
Grate surface,	123 sq. ft.
Fire "	3570 "
Number of flues,	18.
Internal diameter of flues,	18 and 30 inches.
Length of tubes,	8 and 13½ feet.
Diameter of smoke pipe,	72 inches.
Height "	32 feet.
Weight of boiler *without water*,	93,800 pounds.
Description of coal,	Anthracite.
WATER WHEELS.—	
Diameter of water wheel,	28 feet.
Length of blades,	9 "
Depth "	26 inches.
Number "	24.

Remarks.—Solid floor; 13 inches centre, side and bilge keelsons; iron lattice braced; square fastened throughout, and coppered; one 6-inch independent fire pump, and one 5-inch injection pump.

For the Journal of the Franklin Institute.

Particulars of the Steamer Nashville.

New York.—Hull built by William Collyer, New York. Machinery by Novelty Works, New York. Owners, Spofford, Tileston & Co. Intended service, New York to Charleston.

Hull.—	
Length on deck,	216 feet.
Breadth of beam at midship section,	34 " 8 inches.
Depths of hold,	22 "
Length of engine and boiler space,	64 " 6 "
Capacity of coal bunkers in tons of coal,	185 tons.
Draft of water at load line,	12 feet.
Floor timbers, moulded,	14½ inches.
" sided,	14½ "
Distance of frames apart at centres,	29 "
Masts and rig,	Foretopsail Schooner.
Tonnage,	1235
Engine.—One—Side lever.	
Diameter of cylinder,	86 inches.
Length of stroke,	8 feet.
Maximum pressure of steam in pounds,	28
Maximum revolutions per minute,	19
Boilers.—Two—Miller's patent return flued.	
Length of boilers,	24 feet.
Breadth "	12 " 3 inches.
Height " exclusive of steam chimney,	12 " 3 "
Number of furnaces in each boiler (3 above, 2 below),	5
Length of grate bars,	7 " 2 "
Number of flues,	33
Internal diameter of return flues,	10, 11, 13, and 15 inches.
Diameter of smoke pipe,	6 feet 4 "
Height of smoke pipe,	38 "
Draft of furnaces, natural.	
Fire surface in each boiler,	2274 "
Description of coal,	Anthracite.
Water Wheels.	
Diameter of water wheel,	32 feet.
Length of blades,	10 "
Depth "	20 inches.
Number "	28

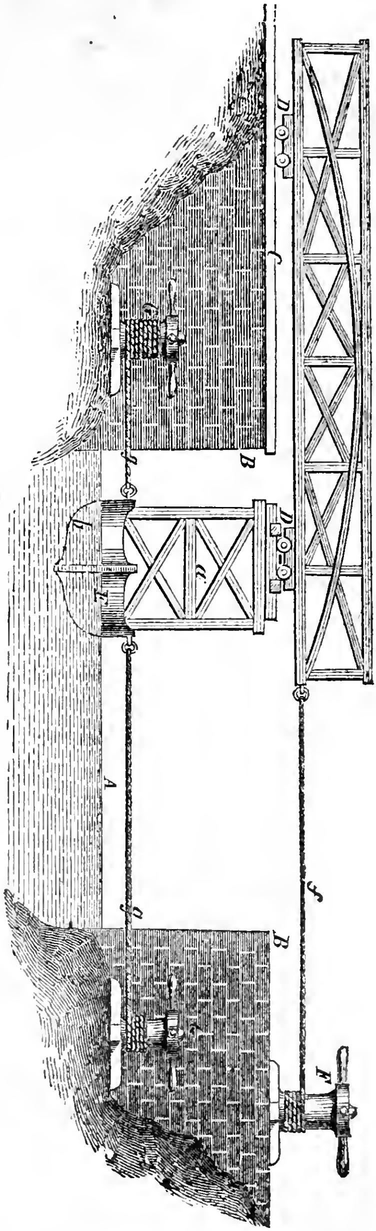
Remarks.—Floors filled in solid. Blowers to ventilate fire-rooms.

Champion's Mode of Building and Transporting Bridges. (Patent antedated May 22, 1853.

This engraving is a side view or elevation of Thomas and Sumuel Champion's improved mode of building bridges on the land, and conveying them to their places over streams.

The cardinal feature in this mode is, the building of the bridge on the land, at about the level with its intended position, on a prepared roadway C, on one of the previously prepared abutments B B, on which

the trucks, D D, are placed for the land part of the transportation. Which having been accomplished, a vessel or vessels E, of sufficient buoyancy for the burden to be imposed, having upon it a frame work, A, of proper height, is floated by the stream A, either under the already projecting end of the bridge, or against the abutment, for the purpose of having the bridge rolled upon it. The vessel being provided with a valve to receive, and a pump to discharge water, it may be ballasted therewith, and its buoyancy regulated as desired; after which, all things being in readiness, by means of the capstans, F G, with the ropes, *f g*, attached, the vessel and bridge upon it may be speedily and safely drawn over its place, and lowered to its proper position, by letting water into the vessel, or by jack-screws or other process.



It is claimed for this mode, that a great saving is effected thereby, over the old mode of timber supports from the bed of the stream, even where such supports are practicable, but where the streams are deep, the currents rapid, and the bridge high above the water, such supports are always dangerous, liable to be carried away with freshets, and in some cases positively impracticable.

It is further claimed that the advantages are equally in favor of this mode, over that adopted in placing the celebrated Britannia Tubular Bridge over the Menai Straits, as it is nearly, if not quite as convenient and safe to build the bridge at once at the right as at any other height, while it is much easier and safer to move the whole affair on a level, or inclined properly prepared road and flotilla, than to raise the whole weight by any process perpendicularly to its place.

By this mode all the danger incident to working over the water, all the cost and danger of raising such heavy structures from the water, is avoided, by means as simple and safe as they are beautifully effective.

Translated for the Journal of the Franklin Institute.

Explosion of Mines at a distance.

M. Dumoncel has conceived the idea, which we think a happy one, of substituting the mechanical action of electric currents, in place of their physical action; and he has made an apparatus of very little cost, working at all distances, and capable of acting on an unlimited number of mines at a time.

Let us suppose an electro-magnet of fine wire, fixed in one of the walls of a little oaken box; the spring armature carrying a detent button: a vertical match-holder is secured to a spring strongly bent by this button; along the path which the match will describe when the spring unbends, is sprinkled fine powder communicating with a fuse which transmits the ignition to the mine.

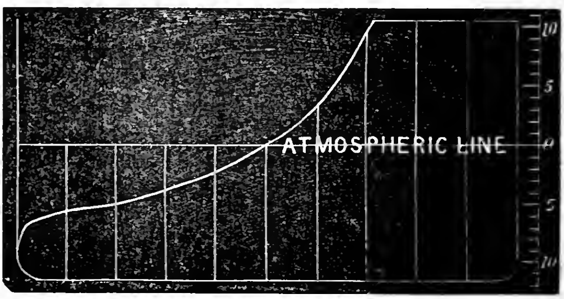
Every thing being thus arranged, the current is established; the electro-magnet attracts its armature; the spring escapes; the match rubs and is ignited, and the mine explodes. If it is required to explode a certain number of mines at a distance from each other, the current passes from one apparatus to the other. To effect this, M. Dumoncel adds to the apparatus above described, a plate, against which the spring which carries the match rests when unbent, and this is made to close a second circuit, and so on.—*Cosmos,* iv, p. 29.

Why not simply connect all the electro-magnets in one circuit?—Ed.

For the Journal of the Franklin Institute.

United States Steamer Powhattan.

The following steam logs are abstracts of the performance of this ship, at different times, while cruising in the China Seas. They were communicated to a correspondent by one of the engineers of the ship, and may be considered authentic. Com. Pub.



U. S. Steamer Powhattan, date, 26 Feb., at 3·20 P. M.

Mean pressure indicated,	13·56
" " due to initial pressure and expansion,	14·22

Port engine, lower ends of cylinder.

Revolutions per minute,	9
Pressure of steam,	11
Throttle valve open.	
Vacuum per gauge,	26½
Temperature of hot well,	102°

Moderate wind ahead with considerable sea.

PERFORMANCE UNDER STEAM ASSISTED BY SAIL.

Date. 1853.	No. of consecutive hours.	Speed of vessel in ft. pr hr. in knots of 6120 feet.	Course of the vessel.	Wind. Direction.	Wind. Kind.	Sail.	Sea.	Immersion of lower edge of paddles in feet and inches.	Engine. Steam pressure per square inch in lbs. above atmosphere.	Engine. Double strokes of piston per minute.	Engine. Steam cut off at from com. of stroke.	Engine. Back press. in condenser per gauge.	Engine. Proportion of throttle open.	Boilers. Number of furnaces in operation.	Boilers. Pounds of coal consumed per hour.	Boilers. Kind of coal.	Speed of the vessel in feet per hour.	Speed of the centre of pressure of the paddles in feet per hour.	Oblique action of the paddles.	Slip of the centre of pressure of the paddles in feet per hour.
Feb. 20, 21,	23	9·25	East.	Abeam.	Mod. to fresh.	Sing. rfd. topsail.	Mod. to rogh. abm.	6 9	9·4	10·75	42	2½	8	Ten.	2997	Cumberland and bituminous.	56·610	60·114	25·96	5·82
Mar. 8, 9,	14	7·67	S W by W	N. E.	Gentle.	Do.	Moderate.	7 3	7·6	8·76	45	2½	8	Eight.	1891	Newcastle and Welsh.	46·940	48·895	27·94	4·
Jun. 8 to 11,	96	9·2	N. E.	On quarter.	Moderat	To' gallant sails.	Do.	5 4	9·75	12·2	40	2½	8	Ten.	3285	Anthracite and bituminous.	56·304	68·259	20·18	17·2
Jul. 19, 20,	23	9·6	N W by N ½ N.	Do.	Do.	Fore & aft.	Do.	6 4	11·15	11·3	40	2½	8	Ten.	3721	Lebanon and bituminous.	58·752	63·170	23·38	7.
Performance under Sail, Steam acting as Auxiliary.																				
April 29 to May 1,	59	10·2	E'd. and S'd.	N'd. and W'd.	To'-gal't. breeze.	To'-gal'nt. sails.	Mod. aft.	6 5	9·56	11·35	31	2½	8	Eight.	2745	Anthracite and bituminous.	62·424	63·427	23·6	1·58
Aug 6 to 9,	84	7 9	E. N. E.	S'd. and W'd.	Gentle.	Do.	Moderate to smooth.	7 3	10·7	9·35	32 8	2½	7	Seven.	2323	Do.	48·348	52·173		·7
Performance under Steam unassisted by Sail.																				
Mar. 24 to April 1,	204	8·4	S. S. E.	Ahead.	Gent. to smooth.	None.	Moderate.	6 3	9·2	11·17	58	2½	8	Ten.	3585	Welsh and Newcastle.	51·408	62·422	23·0	17·64
Ap 5 to 12,	192	8·41	SSE½E.	Do.	Moderat	Do.	Do.	5 10¼	11·5	11·5	56·5	2½	8	Twelve.	3635	Newcastle.	51·469	64·239	21·5	19·87
May 2 to 4,	72	8·42	E. ¾ S.	On bow.	Fresh.	Do.	Heavy.	5 11	11·2	10·8	50	2½	8	Ten.	3657	Anthracite and Cumberland.	51·530	60·330	21·67	14·58
" 8 to 10,	49	10·1	E. N. E.	N. E.	Gentle.	Do.	Smooth.	5 0	11·33	14·33	45	2½	8	10 for 11 hs., and 12 for 38 hours.	3824	Do.	61·812	80·176	18 15	22·9
" 28 to 30,	72	7·93	E. N. E.	Nd & Ed.	Moderat	Do.	Rough.	6 9	11·07	9·78	55	2½	8	Twelve.	3607	Anthracite.	48·531	54·531	25·96	11·0
Performance under Sail alone, with Paddles removed.																				
March 14,	24	3·58	S'd. and E'd.	N. E.	Light trades.	All draw'g sail set.	Smooth.													
" 18 to 22.	120	5·1	"	Do.	do.	do.	do.													

For the Journal of the Franklin Institute.

Naval Steamers.

Having observed, recently, in several of the public papers, articles extolling the virtues of the U. S. Steamers *Susquehanna* and *Powhattan*, now belonging to the Japan Squadron, and knowing that the reports published were not a fair statement of facts, but were furnished for publication by interested parties, I have thought it worth the trouble to obtain the following facts, so that each may have that credit which is justly their due. The Japan Squadron of steamers consists of the *Mississippi*, of 1800 tons, *Susquehanna*, 2400 tons, and *Powhattan*, 2400 tons; the former has been in commission since 1841; the latter are now on their first cruise. Their total cost, at the time of their first cruise, has been as follows:—

Mississippi,	\$569,670 =	\$316·48	per ton.
Susquehanna,	743,044 =	309·60	"
Powhattan,	788,160 =	328·40	"

The machinery for each one cost—

Mississippi,	\$243,784 =	\$135·44	per ton.
Susquehanna,	332,766 =	138·65	"
Powhattan,	389,980 =	162·45	"

From this table it will be seen that while the *Mississippi* was built at an early period, (her side lever engines being the first, of any magnitude, made in this country,) when heavy forgings and castings cost much more per pound than at present; yet her *solid* side lever engines cost but a trifle more per ton than the inclined engines of the *Susquehanna*, and much less than those of the *Powhattan*, although the latter form of engine has been claimed to be the best, by those who wish to extol the new at the expense of the old. A few facts will show which is the most to be relied on. The *Mississippi*, up to the latest dates from her, had on this cruise steamed nearly 30,000 miles, and was then in perfect order for service, and at no time since leaving Norfolk had she been out of order, but at all times was ready to go when wanted. The *Susquehanna* has had a series of small mishaps, and at present has two air pump beams cracked, (which have been secured) and will have to be furnished with a new centre shaft before she returns home (which has been sent to her). The *Powhattan* required 10 weeks after she arrived out at China, before she was reported for duty. My object has been to show that our first steamer has been the most efficient; that her machinery, which was well made, has stood the test of time, and been well tried on nearly all our naval stations, and that to-day she is what she always has been, the *most reliable steamer* in the Navy.

FULTON.

Translated for the Journal of the Franklin Institute.

Description of the Interferential Refractometer of Arago.

If two beams of white light, proceeding from the same source, are propagated through the same homogeneous medium, and have followed paths which are very nearly equal, they form, wherever they cross each

other at a slight angle, a compound system of dark and light fringes, easily visible. The central fringe is the least colored; it is nearly either white or black, white between two blacks, or black between two whites, and this character is sufficient for its recognition. In the place which it occupies, the interfering rays have passed over exactly equal distances. Everything, intensity and color are symmetrical on each side of this central fringe. M. Arago determined, many years ago, that the relations of the paths described did not alone determine the place of the fringes thus formed by the interference of the two beams of light. By placing in the air, an exceedingly thin strip of glass, in the path of one of the beams, he found the bands incline towards the slip. This experiment, repeated a great number of times, with all kinds of solids, liquids, and gases, leads to a law which connects, in a very simple manner, the displacement of the fringes with the refracting power and thickness of the transparent body which is thus traversed by one only of the two beams.

So soon as he had discovered this entirely new mode of measuring the refractive powers of transparent bodies, M. Arago was led to apply it to the study of this power in moist air. It was, in fact, very important to know certainly whether the hygrometer was to be taken into consideration, in the calculation of astronomical refractions; it is a question already treated by two illustrious physicists; first, by La Place, by the aid of the general supposition that vapors, and the liquid from which they come, have the same refracting powers,—a supposition very plausible, on the hypothesis of emission, but not confirmed by subsequent researches; afterwards by Biot, by experiments as accurate as the method used admitted of. Fresnel joined Arago in performing the experiment, which he had desired, and the following is the way in which it was tried: two tubes of thin copper, of about a metre in length, were soldered together, like the two barrels of a double-barrelled gun; at each extremity these two tubes were closed by the same plate of glass, with parallel faces. Stop cocks admitted the substances to be experimented on. When the tubes held air of the same density, temperature, and dryness, the beam which traversed the right hand tube, produced, by mixing, as it came out, with that coming from the left, colored fringes, whose place coincided almost exactly with that of the fringes resulting from the reaction of these same beams propagated through free air.

If, while the elastic force in the two tubes remained equal, one contained chloride of calcium and the other water, the tubes being then filled, one with air completely dry, the other with air saturated with moisture, the bands formed by the interference of the beams traversing each a metre of air in the two tubes, no longer occupied the same place as in free air; the interposition of the tubes caused a notable displacement equal to the breadth of one and a half fringes; this displacement was always toward the side of the dry air.

The direction of the displacement proved, in the first place, incontestibly, that dry air had more refracting power than moist air; the ratio remained to be determined. From the law which we explained above, or from experiments made on the reduction of the pressure necessary in one of the tubes, in order that the fringes should be displaced by a fringe and a half toward the opposite side, the ratio of the refractive power of the two

airs might be directly determined. But it was possible that a slight coating of moisture might have been deposited on the internal surface of the two glasses in the damp tube; now, such a deposit, however thin, might be supposed to play an important part in the phenomena, and would mask a great part of the effect looked for. This was the difficulty which deterred Fresnel from giving any numbers in support of the conclusion which he and M. Arago drew from their joint experiment.

This difficulty M. Arago has since entirely removed, by repeating the former experiment by means of two other tubes, the one dry, the other moist, closed at their extremities by the same glasses which had been used before; but this time they were but one centimetre, in place of a metre, in length. The influence of the difference of the refracting power of the two airs being thus almost eliminated, nothing was left but the effect of the film of moisture, precipitated on the interior surface of the two glass plates in the moist tube; this effect was always inappreciable. The displacement, therefore, of a fringe and a half observed in the tubes one metre in length, depended exclusively on the comparative refracting powers of dry air, and air saturated with moisture. The difference at 25° Cent. (77° F.,) was such that if we assume as the ratio of the sine of the angle of incidence to that of refraction, when light passes from a vacuum into dry air, the number 1·0002945. This ratio, when the light passes from vacuum into moist air, (saturated,) becomes 1·0002936. A difference in the seventh decimal place of the indices of refraction is thus shown in experiments in which the ray has been refracted. Let us add, that, as the exactness of the method is proportional to the length of the tubes, nothing prevents us from going much further with it.

This experiment will be completed by another. It is required to know whether heat exercises upon the refractive power of air any influence except that due to its power of dilatation. The doubt merits examination the more, since warm glass refracts more than cold glass. In order to leave nothing undetermined in a question of such importance as that of astronomical refractions, it remains still to study the influence of electricity at rest or in motion. All this is now accessible, and will soon be cleared up.

We will briefly indicate some other applications of which the method of M. Arago is susceptible, and which he has explained to the Academy. Let us conceive of a tube of a certain length, void of air, closed at its two extremities by plates of glass and hermetically sealed. By selecting properly these two pieces of glass, and a third movable plate, intended to be placed in the path of the external ray, we may cause the interference-fringes of the rays passing through the air and vacuum to be formed, by an effect of compensation, exactly as though they had passed through a homogeneous medium. Only, if the external atmosphere changes its refracting power, the fringes will be displaced, their movement being toward the tube when the refractive power diminishes, and the reverse when it increases. Such an instrument might then be employed in observatories, in place of the barometer and thermometer, for the determination of the respective power of the atmosphere. The observation might be made at the height of the object glass of the instru-

ment, and would put an end to the interminable disputes as to the use of the external or internal thermometer in calculating refractions.

The refracting power of air is a function of its pressure and temperature; the pressure remaining constant, if the temperature varies a single degree Centigrade (1·8° Fah.); the fringes in an instrument 11 decimetres (43 inches) long, would be displaced by the breadth of ten entire fringes. This movement may be measured to the tenth of a fringe-breadth.

The instrument described may, therefore, when combined with a barometer, serve to determine the temperature to 0·05° Cent.

This extreme sensibility may be indefinitely increased by increasing the length of the vacuum tube; but this is one of the least advantages of the method. A thermometer, being under the influence of the radiation of the sky, of the ground, and of all surrounding objects, never gives the temperature of the air. On the contrary, the result deduced from a property of the atmosphere, which is a function of its temperature, is completely protected from all these causes of error.

On journeys, if one was contented to take the atmospheric temperatures such as they are now determined by the thermometer, the vacuum tube might serve as a barometer. A length of tube of one metre (39·4 inches) would permit the appreciation of variations of pressure of from 0·1 to 0·2 of a millimetre (0·0039 to 0·0078 inch). A barometer without a liquid would appear singular enough, but travellers would, especially, remark its small fragility.

M. Arago has shown that his method for determining refractions may be used to determine the state of the atmospheres at all distances from bodies, whether heated or not; to follow the interesting experiments of Faraday upon the atmospheres of mercurial vapors, and their diminution of density as the distance from the liquid increases; perhaps even with tubes sufficiently long, to make sensible the influence of odors. The quickness of the observation permits us, moreover, to conceive the hope that by giving the tube a proper direction in reference to an energetic centre of sound, several properties of sonorous waves may be made sensible to the eye.

As to liquids, it results from observations already made, that by the observation of fringes we may detect, even near the maximum of density, changes of refraction in water corresponding to 0·025° Cent. Who does not see here a new and very precise method of studying the propagation of heat in this kind of bodies, without breaking their continuity by introducing into them the bulb and stem of the thermometer. The same remark applies to the study of the propagation of heat through transparent solids.

Finally, even the increase of the refractive power of water and glass, resulting from the compressibility of these substances, may be detected by the aid of these new instruments. With a tube a metre in length, the compressibility of water for each 0·02 of an atmosphere will be visible; on a tube of glass, of the same length, 0·01 of an atmosphere will become sensible.

This interferential barometer and thermometer would be susceptible of great improvement if we could solve a difficult problem, of which the distinguished physicists, MM. Arago and Babinet, have not yet suc-

ceeded in finding a solution. It is required to bring two luminous rays, separated several centimetres, to conditions of useful interference, without many preceding trials.

In a following number we will give the drawing, description and theory of the instrument as constructed by M. Soleil. We will also add the result of some experiments made under the direction of M. Arago, by MM. Laugier, Soleil and Duboscq, on the refracting form of fog compared with that of pure air.—*Cosmos*, vol. iv, p. 8.

Translated for the Journal of the Franklin Institute.

Verités Electro-Magnetic Safety Apparatus for Railway Trains.

In a preceding number of the Journal we gave a description of an electric clock, by M. Verité, of Beauvais, extracted from the Parisian journal, *Cosmos*. From the same journal, for 6th January, we take a notice of another invention, by the same author, for the purpose of guarding against accidents to railway trains, much resembling in its principle the safety switch of Mr. MacRea, described at page 138 of this volume.

"We will suppose, for the sake of fixing our ideas, that it is required to regulate the running of the trains on the Northern Railroad from Paris to Amiens. At each end are placed two connected dials, supported on a small pillar of wood or cast iron, one of them facing Paris, the other Amiens, so placed as to be easily seen by the engine drivers when they arrive at the station. Each of them carries a plainly visible needle, and their circumference is divided into as many parts as there are kilometres* between the two consecutive stations at which they are placed. Each of these spaces is numbered, beginning with this at the upper part of the dial, which is 0.

Let us suppose that a train leaves the Northern Depot, and that the first station is at St. Denis, distant from Paris 8 kilom. The dial at Paris will be divided into eight equal parts, and, at the departure of the train, the needle will be vertical, its point showing 0. When the train has run 1 kilometre the needle will pass from 0 to 1; it will pass to 2 when the train has run 2 kilometres, and so on; so that, if the train arrives at St. Denis without interruption, the needle will have described the whole circumference, and will have returned to 0, ready for the departure of the next train. The first locomotive, on reaching St. Denis, will come into communication with a second dial, (whose index is also at 0,) divided into as many parts as there are kilometres between St. Denis and Enghien, the second station. The train, in its progress, will operate on the dial at St. Denis as it operated on that at Paris, and when it has reached Enghien, the index at St. Denis will have returned to 0. And this operation will take place from station to station, until the train reaches the extremity of the line.

In this way the progress of the train may be followed from station to station, kilometre by kilometre. If any accident should happen, or any

* The Kilometre is the French unit of distance, corresponding to our mile. Its length is about 0·62 of a statute mile.

delay in the train, notice will be immediately given by the movement of the hand on the dial; the needle stopping at the same time as the train, will show by the number to which it points, the distance at which the accident has happened.

In general, the service of the most crowded lines does not require that the trains should be running at the same time between any two stations. In fact, the distance between no two stations is more than 20 kilometres at most, which the locomotive runs over in less than 25 minutes. To suppose that two trains are at any time between the same two stations, is to admit that the trains are running within 25 minutes of each other; but the interests of the passengers, whose safety should be secured as far as possible, as well as the interests of the company, which must take care of their stock, demand, it seems to us, that the trains should not run closer than this.

As then the conductors of the trains will see, immediately on their arrival at any station, where the train ahead of them is, and as they will not quit that station until the needle of the dial, by its return to 0, shows that the first train has reached the next station, it will be absolutely impossible for the second train to run into the one before it.

In exceptional cases, where trains have to run more closely than this, and where, in consequence, two trains may be between the same stations, it will be easy to establish one or two systems of connected dials between the stations.

We will now explain the method devised by M. Veritè to secure the motion of the index on the dials.

Behind each dial is a wheel, with a number of teeth equal to the number of kilometres between the two stations; this wheel is governed by an escapement, which allows one tooth to pass every time that it is moved. The escapement is put in motion by the attraction of an electro-magnet, operated on by a current, which is closed by the locomotive itself, every time that it has run 1 kilometre.

One of the poles of the battery is put into communication with a wire, hung like our ordinary telegraph wires, upon posts, along the track. At every kilometre a branch of this wire is taken down and terminates by an inclined plane near the rail; the other pole communicates with the ground, or, still better, with one of the rails of the track. The locomotive or tender is also supplied with a movable piece of metal, terminating in an inclined plane, and so placed as necessarily to meet as it passes the inclined planes in which the conducting wires terminate. Thus, with whatever speed it may be running, at arriving at the end of the kilometre, the locomotive will always close the circuit; the closed circuit will magnetize the wire, which will work the escapement, the escapement will pass one tooth of the wheel, and the index moving forward one number will indicate that the train has made one kilometre more.

If it be required to prevent the much more rare accidents caused by the collision of two trains moving in opposite directions on the same track, special dials may be placed and properly arranged, on which the conductors may read as they pass, the distance which separates them

from the train moving towards them. They will then slack their speed, or take other means to avoid the collision.

M. Veritè has constructed, in his shop at Beauvais, a model, on a small scale, of the apparatus which we have described. This apparatus succeeds so well as to render him almost certain of its success on a large scale. He is now ready to apply it on a line of railroad, as soon as he may be invited to do so by his Excellency, the Minister of Public Works."—*Cosmos*, vol. iv, p. 7.

On many of our crowded roads the principle of this ingenious contrivance would be, doubtless, found of very useful application. It is, as we have said, fundamentally the same as that of Mr. MacRea, which we have already commended to the notice of our readers. In our country the most frequent and the most terrible accidents are those arising from the collision of opposite trains; and here the signal of Mr. MacRea commends itself particularly to the attention of those who desire to travel as well safely as fast.

Translated for the Journal of the Franklin Institute.

Consumption of Fuel in Steam Engines with single and double Cylinders.

M. Farcot, machinist, at Port St. Ouen, has made experiments upon two machines made by him for the plate-glass manufactory of St. Gobin, which may serve as a basis for a rigorous comparison between machines of one and two cylinders. The experiments were made under the direction of M. Laforet, engineer of the glass-works at Chauny. The first machine, with two cylinders, has a nominal power of 30 horse, and makes 28 revolutions per minute. When tried on the 26th October, during 5 hours, at 38 horse-power, under a pressure from 4·75 to 5 atmospheres, it consumed less than 1·15 kil. ($2\frac{1}{2}$ lbs.) of common charcoal per horse-power per hour. Afterwards tried at 45 horse-power, it worked with the greatest ease.

The second machine is horizontal, has but one cylinder, working at 42 revolutions per minute, and is also nominally 30 horse-power. Tried for 5 hours on the 28th October, it consumed only 1·106 kil. (2·4 lbs.) per horse-power per hour. Afterwards tried at 49 horse-power, it gave no evidence of injury to any of its running parts. These two machines have now been in regular service for several months, and work usually with a force of from 40 to 45 horse-power.

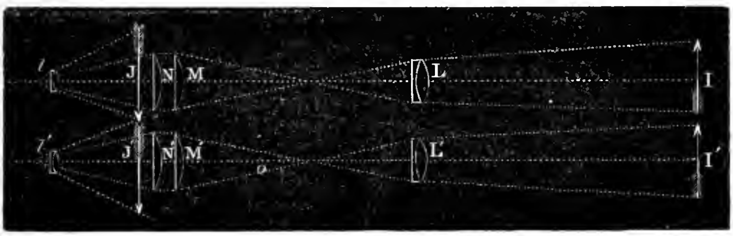
It has been hitherto admitted, that the double-cylinder machines expended less steam and fuel than those with but one cylinder. The preceding experiments show, that when well constructed, the expenditure is the same in both systems. If it be true theoretically, that the double-cylinder machines work more regularly, it is now certain, that practically, the one-cylinder machines of M. Farcot work with a perfect regularity. Horizontal (*oscillating?*) engines, for instance, drive spinning machinery, and paper works more regularly than the hydraulic motors which they replace, and actually leave nothing to be desired. Their price, for equal force, is less than that of fixed machines, and their velocity is in better adjustment to that of the shafts which they drive.

Our readers will observe the low rate of consumption in these two machines; it is much less than that required for the best engines turning an axis, hitherto known. The arts have therefore realized in this respect, an immense progress of 2 or even 3 kilogrammes ($4\frac{1}{2}$ to $6\frac{1}{2}$lbs.) per horse-power per hour. This advance is especially due to the Society for the Encouragement of National Industry, for they have always excited, proved, sanctioned, and recompensed it.—*Cosmos*, iv, p. 41.

Translated for the Journal of the Franklin Institute.

The Cosmoramic Stereoscope of Duboscq.

At the bottom of a rectangular box, 40 inches long, 7 inches wide, and 4 inches high, a couple of stereoscopic images of $\frac{1}{8}$th plate upon albuminized glass are fixed; in front of each of these two objects are fixed in the box, two achromatic lenses, whose distance from the plates is greater than their focal length so that the plates are beyond their foci; in the paths of the rays as they leave the lenses and beyond the point at which they cross, are erected systems of plano-convex lenses, like the lenses of a Huyghens eye-piece, and of large diameter; the enlarged images are examined through lenses which again magnify them. The lineal dimensions of the stereoscopic objects are thus magnified twelve times, and their surface one hundred and forty-four times, while the effect of relief is perfectly kept.



The figure annexed will give a still more perfect idea of this apparatus, and of the path of the rays of light. I, I′ are the two stereoscopic plates; L, L′ the two lenses; M, M′, N, N′ the couples of plano-convex lenses; J and J′ the resulting images; L, L′ the magnifying glasses through which they are looked at.

In reality, the cosmoramic stereoscope is, in its essential composition, an ordinary microscope, whose magnifying lens is an object glass of long focus, and whose field-lenses have a large diameter.

Cosmos, vol. iv, p. 33.

For the Journal of the Franklin Institute.

The Ericsson

Has at last made a short trial trip, having reached Staten Island, a distance of seven miles from New York, when her pistons were found to leak so badly, that she was taken back to her old berth, at the works of

Messrs. Hogg & Delamater. Her engines attained a speed of six and a half revolutions per minute during the trial. Report says, that the present engines are to come out and a pair of enlarged size (between the present and those first used) are to be put in. If this is true, what may we not expect from the credulity of the age.

For the Journal of the Franklin Institute.

The U. S. Naval Steamer, Princeton,

After having her machinery refitted (taking out Sickel's cut-off valve,) has recently made a trial trip of three days at sea, when her engines and boilers were found to operate to the satisfaction of the engineers on board, and she is now reported ready for duty.

Notice of Steam Ship Himalaya, the largest Steamer in the World.

The English have just built the iron screw steamer Himalaya, belonging to the Peninsular and Oriental Steam Navigation Company.

The *Himalaya* is the largest ocean steam-ship in the world. She is 3550 tons register, equal to over 4000 tons burthen, and is of the extraordinary length of 372 feet 9 inches. The length of the keel is 311 feet; breadth for tonnage, 46 feet 2 inches; depth of hold, 24 feet 9 inches. These proportions, when contrasted with the dimensions of other ships, give a great advantage, particularly in length, to the *Himalaya;* for example, the *Duke of Wellington*, of 131 guns, although of greater beam and depth, is inferior in length by ninety-two feet to the *Himalaya.* The screw steamer *Great Britain* is 332 feet long, or forty feet shorter than the *Himalaya;* while the American clipper ship *Great Republic*, recently destroyed by fire in New York, was only 325 feet long, or of forty-seven feet less length than the *Himalaya.* Although the *Himalaya* exceeds in so large a degree the length of the *Duke of Wellington*, yet she is inferior in tonnage to that ship, the *Duke* being $3759\frac{4}{94}$ tons, or about 209 tons larger than the *Himalaya.* The cylinders of the engines are of 84 inches diameter, with a $3\frac{1}{2}$ feet stroke, and the revolutions per minute are from 50 to 60. The screw is a two-bladed one, on the old principle, of 18 feet diameter, with a 28 feet pitch, and weighs nearly seven tons. The vessel is full ship rigged; and the masts, spars, and sails which have been supplied, are those suitable for a clipper sailing ship of 1600 or 1800 tons.

---

*Title Deeds in Times of Yore.**

We lately saw, for a moment, the deed of the conveyance of an estate of about 300 acres of land sold by the Earl of Hereford, in 1226, or 627 years ago, the total writing of which measured $5\frac{1}{2}$ inches wide by $2\frac{3}{4}$

* From Herapath's Journal, June, 1853.

deep. His lordship's seal was attached by a ribbon, being a clumsy piece of wood with his arms carved thereon. From the circumstances under which we saw it, we could not read it, but both in dimensions and character, it was a good specimen of the business brevity of olden times.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, February 16, 1854.

Samuel V. Merrick, President, in the chair.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from Lieut. George F. Emmons, U. S. N.; The Massachusetts Charitable Mechanics Institute, Boston, Mass.; The Maryland Institute, Baltimore, Md.; Henry R. Campbell, Esq., Lebanon, N. H.; George H. Hart, Esq., and M. W. Baldwin, Esq., Penn. Legislature; Solomon W. Roberts, Esq., Pittsburg, Penna.; and The Mine Hill and Schuylkill Haven Railroad Co.; Conger Sherman, Esq.; M. B. Smith, Esq.; George M. Conarroe, Esq.; and Prof. John F. Frazer, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of January, 1854.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Science and the Arts, reported the following Memorial, with a recommendation that it be adopted; which was done, and it was ordered to be signed by the officers of the Institute, and forwarded to both Houses of Congress, viz.:

To the Senate and House of Representatives of the United States, in Congress assembled:

The Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, respectfully present to your consideration a subject of great practical and social interest, and ask for it such action as its importance warrants.

The government of Great Britain has recently made a partial change in one of the denominations of its coinage, and others are under consideration which will tend, if adopted, to enlarge and perfect the decimal system, which is the basis of the new coin.

A movement of this sort, by a nation so kindred to our own, in its language, institutions, weights, measures and general policy, is viewed

as a highly favorable opportunity for endeavoring to make the coinage of the two countries perfectly identical in weight, value, and fineness, and, in fact, in everything but mere name.

An inspection of any table showing the value and other characteristics of the coins now in use in the two countries, will demonstrate that no very disturbing element would be introduced by thus equalizing the coinage.

While great and important social and commercial advantages would flow from the proposed change, the disadvantages, if any, would be so small as not to affect, sensibly, the relations of contracting parties.

The constant and rapidly-increasing intercourse between the two countries carries the respective coins of each into the other, and they are then either broken up and re-coined, or await the demands of trade for the settlement of accounts, by which they are returned to the points of original issue.

Every re-coinage is attended with considerable expense and some loss, and the process is now repeated so often in the great commercial countries, that it claims the study of every friend of national economy.

While such considerations weigh, to some extent, with every people, they press with peculiar force when applied as between Great Britain and the United States. Practically, the dealings of the two nations with each other and with the rest of the world are settled in their own commercial and financial centres, and hence it follows that the settlement of accounts in an identical coinage would be as simple as is now the computation of yards and pounds.

It is deemed unnecessary to present any special plan of weights, or other details for the accomplishment of the uniformity we are seeking to obtain; such details must be settled by the legislative and treaty-making powers, and to their wisdom they may be safely left.

All that we desire to urge, is, the fact that Great Britain has the subject of its coinage under discussion, with a view to its change, in whole or in part, to a decimal notation, and that an opportunity now exists for treating with her for the desired identification of coins, that may not soon occur again.

It is deemed fitting that those two nations whose language, institutions, and habits, seem destined to almost universal dominion, should unite in a plan which will simplify their monetary dealings, as their other intercourse is already simplified, and thus enable their citizens to do away with the annoyance of computing the fluctuations of the nominal exchanges, and to use the half eagle of the United States, and the sovereign of Great Britain, and all the multiples and sub-multiples of them, as measures of value in either country, without change or calculation, just in the same way that the coins of one pass in its respective states, and of the other in its several counties and territorial divisions.

Our memorial therefore asks that such legislation may be had by your honorable bodies, as will authorize the executive authority of the Union to negotiate with the government of Great Britain on this important subject, and to carry into effect, with the least possible delay, the changes in the coin, that the adoption of uniformity may render necessary.

And your memorialists will ever pray, &c.

New Candidates for membership in the Institute (5), were proposed, and those proposed at the last meeting (3), were duly elected.

The Standing Committees for the ensuing year were nominated by the President, and appointed, as follows:

On the Library.	*On Cabinet of Models.*	*On Exhibitions.*
John Allen,	Samuel S. Ash,	John E. Addicks,
James H. Cresson,	James J. Clark,	John Agnew,
George Erety,	Edward P. Eastwick,	John C. Cresson,
Raper Hoskins,	William T. Forsyth,	Geo. W. Conarroe,
William S. Levering,	Israel W. Morris, Jr.	Owen Evans,
James Lukens,	F. De B. Richards,	And. M. Eastwick,
John P. Parke,	James D. Rice,	William H. Love,
William A. Rolin,	Charles J. Shain,	Algernon S. Roberts,
Clement W. Smith,	John A. Wimer,	Isaac S. Williams,
Thomas S. Stewart.	Charles Welsh.	Thos. J. Weygandt.

Cabinet of Minerals and Geological Specimens.	*On Meetings.*	*Cabinet of Arts and Manufactures.*
John F. Frazer,	Charles M. Cresson,	James C. Booth,
Wm. W. Fleming,	Washington Jones,	Jos. J. Barras,
John L. Le Conte,	Daniel L. Leeds,	Samuel M. Bines,
Angus N. Macpherson,	J. Vaughan Merrick,	George M. Conarroe,
John S. Powell,	B. Howard Rand,	B. Barton Gumpert,
B. Howard Rand,	Fairman Rogers,	William Harris,
Percival Roberts,	Algernon Roberts,	Wm. H. Hazzard,
Lawrence Turnbull,	George W. Smith,	J. M. Sommerville,
John C. Trautwine,	Lawrence Turnbull,	Thomas J. Weygandt,
Charles M. Wetherill.	Charles M. Wetherill.	Isaac S. Williams.

On Meteorology.

Owen Evans,	A. L. Kennedy,
John F. Frazer,	B. B. McKinley,
L. C. Francis,	James A. Meigs,
Jas. A. Kirkpatrick,	Edw. Parrish,
E. Otis Kendall,	Geo. J. Ziegler.

Dr Rand exhibited to the members a beautiful miniature working model of the line of magnetic telegraph from New York to Washington, made for Prof. Morse, by Mr. James J. Clarke of this City, from designs by George Harding, Esq., although very small, the whole works beautifully, and reflects the highest credit upon those engaged in its design and construction.

Mr. Fairman Rogers called the attention of the meeting to the condition of the work executed, about four years ago, on the line of railroad built to avoid the inclined plane, on the old Columbia railroad, and illustrated it by a drawing of one of the arch-ways. The work referred to, is the sustaining wall and two arched passages, extending from the west abutment of the Market Street Bridge, to the first road bridge, a distance of 400 or 500 feet. The wall was built partly over the excavation of the old canal, and had to be repaired some time after its erection, from the unequal settling of the foundations. The coping of the wall now presents an elegant, undulating line, causing the light iron railing above it to assume twists, certainly never contemplated by the maker. The archway nearest the bridge, originally a full centre arch of six feet span, has been disturbed by the pressure upon its haunches, raising the crown so

as to change the line of the intrades from a semicircle, into a figure resembling half of a vertical ellipse; the pilasters supporting the arch are pressed in, and the half piers on each side of the arch, rataining their normal distance apart at the top and bottom, have been pressed in towards each other; in the middle bending out of their vertical direction and cracking the joints between the stones. The arch itself, presents the usual cracks and breaks of an arch failing by excessive pressure on the haunches.

It is to be attributed, probably, to the insufficient thickness of the abutment walls of the arch, and to the employment of a full centre arch which has no horizontal thrust. The arch on the other side of the old canal, in the abutment of the iron road bridge has failed in the opposite manner; the crown sinking, flattening the arch, and disturbing the lines of the piers. The whole of the soffit of both these arches is very much twisted.

The whole work is well worth the inspection of the lovers of fine engineering constructions, although it is sincerely to be hoped, that it will be speedily removed, and a structure of substantial proportions and good workmanship substituted for it, as its very exposed and prominent position on one of the most crowded entrances to the city, renders it a conspicuous object to the approaching stranger.

Dr. Turnbull called the attention of the meeting to the very great importance of proper insulation of the metallic wires of the electro-magnetic telegraph. He exhibited two new forms of insulators. The first was a modification of the form designed by J. M. Batchelder, Esq., of Boston, but omitting the use of iron, and being composed of flint, quartz, and feldspar, very compact, thoroughly vitrified on the surface, was equal to the best forms of glass insulators and much stronger; it is in the form of a cap with a ridge for the purpose of fastening the wire, and an inverted edge so as to divert the rain downward and prevent it from entering the inside of the cap. He remarked, that even this form of insulator is defective, and the moisture settles upon it, and this acts as a carrier of the electricity to the ground. A still further modification of this apparatus is desirable, so as to give the surface of the insulator a downey covering, to cause the moisture to remain in isolated dress upon it; this, Mr. Batchelder is endeavoring to accomplish. He has also produced a change by heat, &c. in the best electric substances known, namely, caoutchouc, so as to render it impervious to moisture, heat, and rapid decomposition and fit it for insulating caps for the tops of posts.

The composition is of a dark color, and in the form exhibited, has a ringing noise when struck. Subjected to water at 212° it did not soften; strong sulphuric acid had no action upon it; even pure nitric acid did not destroy its elasticity, while it completely altered a piece of pure caoutchouc, converting it into a mass of brown color, which, when pressed between the finger falls to powder. The only change noticed was its color, which was yellow instead of black. When placed in the flame of gas it burned with freedom, giving off scintillations as if combined with metallic oxide and leaves a polished surface while ordinary caoutchouc liquid, when burned produced a pyro-oil which stains the fingers so that it has all the qualifications of a good insulating substance, being an electric not affected by a heat of 212°, not altered be acids, and not liable to decomposition.

② JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

APRIL, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America. By John C. Trautwine, Civ. Eng., Philad.

(Continued from p. 154.)

In my first communication respecting this route, my remarks were confined chiefly to a few general observations on the Gulf of Urabá or Darién; and the bars which impede the entrances, mouths, (or bocas,) of the several streams, (caños,) which form the delta of the Atrato; and through which that river discharges itself into the gulf.

In this, I shall proceed in the same manner, to furnish some brief notes, with regard first to the caños themselves; and afterwards to the main River Atrato.

In sounding the caños, below the junction of Caño Coco Gránde with the Atrato, we did not take as many entire transverse sections of the wider ones, as I could have desired. This portion of my operations was performed in a light canoe; and, inasmuch as the proposed object of my mission would be fully accomplished, provided a low water depth of 10 feet could be secured throughout, I frequently satisfied myself with that depth near the shores, rather than encounter the intense heat of the sun, and the greater rapidity of current in midchannel. Under a pressure for time, and the necessity of traveling sometimes forty miles a day, with but two paddlers, it was on more occasions than one, necessary to sacrifice scientific considerations to strictly utilitarian ones.

In ascending the river above the divergence of the caños, opportunities for obtaining entire cross-sections of the stream, frequently presented themselves; as our patron, or captain, always sought the convex sides of the bends in the river, to diminish the labor of his polers or bogas, as the crew are called.

I had, moreover, become previously aware, that no attempt could be made to render practicable, the *entrances* to these wider caños; so that we might even have omitted to sound them at all, so far as the immediate object of my exploration was concerned.

Descending Caño Taréna, below its confluence with Caño Barbacoas, (see Plate I,) the average width varies between 250 and 300 yards. My least sounding near the shores, until within a short distance of its mouth, was 20 feet: but when we were pretty well out in the centre of the stream, the depths generally ranged between 30 and 45 feet. On the convex side of one of the bends, we found 78 feet.

The only shoal spot in Caño Taréna, is opposite the entrance of an extensive lagoon, (see Plate I,) which discharges itself into it on the west bank, at about a mile from the gulf; bringing in soft mud, which forms the shoal.

Our soundings here gave depths varying from but 18 to 22 feet, clear across the caño. Immediately below this shoal, however, we found 28 feet; but below that again, the depth gradually diminished to the mouth.

Caño Barbacoas is, like Taréna, a very beautiful stream; having an average width of from 150 to 200 yards. It is by no means so deep as Taréna. In this caño, also, I contented myself with a depth of 10 feet; but from a few observations taken entirely across, I think it highly probable that a careful series of soundings would indicate a continuous channel of from 12 to 15 feet.

Caño Pava has an average width of from 120 to 150 yards; and a channel way of full 20 feet deep throughout, with the exception of about one-third of a mile of its length next inside of the boca. Descending along this third of a mile, the depth gradually decreased as we approached the mouth; which I found to be very much obstructed by sand from the gulf. None of these three caños, Taréna, Barbacoas, or Pava, has bends so abrupt as to oppose any difficulty whatever to steamboats of the greatest length afloat.

Caño Candelaria is a short, secondary outlet to Caño Pava; (see Plate I.) Its length does not exceed a mile; and its greatest depth (except at its confluence with Pava,) is but 12 feet. It is somewhat obstructed by sunken trees, and appears to be filling up. Caño Urabá was examined only for a short distance at each end. So far as I saw it, it had a width of from 60 to 80 yards, and a safe center depth of at least 25 feet at low water; except near its mouth, where it is wider, but shallower; (see preceding Table of bars.) Even close to its banks, my soundings gave 15 to 20 feet; and nearer the middle of the stream from 25 to 35 feet.

From my acquaintance with similar caños in other parts of New Granada, I have no doubt that a perfectly clear passage for large steamboats exists throughout its entire length, after having once cleared the entrance. Should it present any very sudden bends, they could easily be straightened by dredging.

Caño Coco Grandé is of about the same character as Urabá, as regards width and depth.

Caños Piguindé and Pántano, are but short secondary outlets to Urabá and Coco Grandé respectively, and require no especial notice.

The only one, therefore, that remains to be mentioned, is Caño Coqúito. This is, as before remarked, the most insignificant of all the mouths of the Atrato, (except Piguindé and Pántano, which scarcely deserve to be regarded as separate mouths.) The grounds have also been stated, upon which, notwithstanding its present condition, I should select it in preference to any of the others, for adaptation to a system of improvement on a small and inexpensive scale.

These were, that its entrance is more sheltered from the effects of the Northers, by the Isla de los Muértos; and therefore less liable to periodical changes, or obstructions, from that source. Indeed, from all I could learn, (and the representations made to me were sustained by appearances,) it is almost entirely free from them. The depositions which obstruct its entrance, extend, it is true, to a considerable distance out from the shore; (see Table of Depths, page 149.) But they consist of soft mud brought down by the river, and easily removed by the processes already alluded to; and when once removed, I conceive that the slight current produced in the artificial channel, would prevent their reproduction by forcing them out into deep water.

It may be objected to this plan, that even in deep water, the process of deposition will still continue, and eventually require further appliances; but admitting the force of the argument to the fullest extent, I still conceive that ages might elapse before serious difficulty would arise from that source.

A minute survey might show that it would be a preferable plan, to cut an entirely new channel for uniting Caño Urabá with the gulf, at a point about 3 miles south-west from its present mouth. For larger vessels than those contemplated in my survey, I am confident that this would be far better than to use Caño Coqúito; and possibly it is so in any event.

When we prepared to leave the gulf, in order to ascend the Atrato in the large river boat, in which we had made our voyage by sea from Carthagena, we had to wait for the hour of high water, before we could enter Caño Coqúito. High water gave us a depth of but 3 feet 4 inches for some distance from the entrance, and as the loaded boat drew $3\frac{1}{2}$ feet, and the rudder $4\frac{1}{2}$ feet, we stuck fast.

By unshipping the rudder, however, and putting a portion of the crew into the water to buoy up the vessel, while the remainder plied their paláncas or pushing-poles, we passed through the mouth, when we instantly found ourselves in nearly two fathoms of water.

Caño Coqúito is two miles long, and has a width varying generally from 25 to 35 feet, between the bushes at its sides. In some few spots it is narrower, not exceeding 15 feet, and in others, as wide as 50 feet.

It affords a low-water depth of 10 feet, except over some few very short bars, caused probably by sunken trees. The shoalest of these bars occurs about 200 yards before reaching the junction with Caño Barbacoas. Here we found but 5 feet low-water depth; extending, however, a distance of less than 100 feet. The soft mud and vegetation at the

sides of this caño, could be removed without difficulty, by a dredging machine, and some little chopping; and a channel-way formed of 40 feet in width and 10 feet of low-water depth, at an expense of labor and money, much less than would be required to improve the entrance to any of the other caños.

Subsistence for laborers could be procured from either Carthagena, or Navy Bay. They should sleep in vessels prepared for the purpose.

It will be remembered, that the only class of improvement to which I have reference in my remarks, is that adapted to small steamboats, or other river craft, such as could at almost all times ascend the Atrato to Quibdó, some 220 miles, with a draft not exceeding 6 feet.

The boat in which we traveled from Carthagena to Quibdó, was 68 feet long from stem to stern, and 13 feet beam over all. Draft of hull, $3\frac{1}{2}$ feet: of the rudder, $4\frac{1}{2}$ feet.

The convex sides of bends in the caños, (and, as I afterwards found, in the river also,) being shoaler than the opposite, or concave sides, give luxuriant growth to a species of coarse aquatic grass, here called grammalóte, which, in appearance, somewhat resembles young corn; and also to varieties of the arun, or spatter-dash. The greater depth of water on the concave sides, prevents the growth of these plants; and the trees approach to the very edge of the stream, which their branches overhang. The trees are frequently concealed by dense masses of vines which entirely envelope them, and in certain lights present plays of color comparable only to those of the richest velvet; and which, contrasted with the magnificent plumes of the pángana and murápo palms, afford a display of nature's handiwork, at once unique, gorgeous, and chaste. But like the plumes and velvet of the funeral pageant, they serve but to conceal and adorn corruption. Behind them stretches, far away, the pestiferous swamp, through the dreary wilds of which even the birds refuse to sport; and whose silence is broken only by the sighing of the breeze, or the sullen growl of the roving tiger. The pinnated leaves of the palma pángana are frequently from thirty-five to forty feet long; and springing out from the trunk of the tree at only a few feet from the ground, they precisely resemble in shape and gracefulness, gigantic plumes of ostrich feathers.

On our way along Caño Taréna, we came across a shelter of branches erected on the shore, and temporarily occupied by a family of blacks. Their occupation was fishing; and hunting a kind of wild hog, (the Peccary,) which is occasionally met with in the swamps, during the dry season.

Being the first amphibious human beings we had yet encountered, we made them a friendly call for a few minutes; and purchased from them half a large peccary for half a dollar. These were the only persons we met with in any of the caños. Their canoes were constantly kept ready for a start, inasmuch as a very slight flood would suffice to drown them out.

While descending this same caño in our canoe, we saw the planet Venus with perfect distinctness, and in an unclouded sky, while the sun was shining with full brilliancy, but a few degrees below it.

The manati is abundant in these caños, and for a long distance up the

river. It appears to feed chiefly upon the grammalóte; we frequently saw considerable patches of that grass gnawed off close to the water; and were told that it was the work of this animal.

Although for some years employed in caños in New Granada, abounding with manati, I never saw but one, and even that very indistinctly. It was walking on the bottom of the caño, some feet under water, and passed beneath the boat in which I happened to be at the time. It was of the size and color of a small dun cow. We did not see a single alligator until we had ascended the river some leagues above Caño Urabá. They appear to be somewhat rare in the Atrato.

The only birds we met with in the caños were one or two cranes.

Venomous snakes abound; and are a source of dread to the river boatmen. They repose coiled up among the branches of the trees, overhanging the streams, and not unfrequently are precipitated into the boats by accidental blows of the paláncas, or pushing poles.

The bogas, or crew, are constantly on the look-out for them, and by long practice become wonderfully quick in detecting them. We kept our guns ready loaded for the purpose; and killed several almost every day, to the great gratification of the bogas, who always evinced their pleasure by loud "vivas." Those we shot were generally from four to six feet long.

Wasps are another occasional source of annoyance; and, like the snakes, are regarded with great aversion by the bogas. Our patron appeared to know every wasp's nest between the Bocas and Quibdó; and always gave us timely warning to enter the cabin, and hang up blankets at the doors to prevent their entrance.

The bogas, who at other times are constantly singing, preserve perfect silence on approaching a wasp's nest; and take especial care not to touch with their paláncas, the trees in which they are built. By this means they generally escape being stung.

The wasps are of two species; the larger ones do not sting, unless provoked; but the smaller ones are less considerate, and appear to fight for the fun of the thing.

Instead of entering into a detailed description of the Atrato, I will confine myself to such an outline of its chief peculiarities as will suffice to convey a tolerably correct idea of its general character. In doing this, I shall adopt such subdivisions as suggest themselves to me at the moment of writing; filling them in by remarks hastily taken from my several books of memoranda.

The Natural Levees of the Atrato, extend from the Gulf of Urabá or Darién, almost to the very sources of the river; or up to those points on its several tributaries, at which it begins to assume the character of a torrent.

Although the banks or levees of the caños, (as well as those of the river for a great distance above them,) consist of soft mud; still they do not slope very gently towards, and beneath the surface of the water, as might be supposed. On the contrary, they descend quite abruptly to a considerable depth; so that it is common, in straight reaches, to have nearly the same soundings close to the edges of the stream, and in its

center. For miles at a stretch, we found depths of from 18 to 30 feet, within from 20 to 50 feet of the shores of the Atrato, as well as those of some of the caños.

Near the Gulf, where the tide rises generally about 18 inches, the height of these levees varies from but a few inches, to a foot above the ordinary level of high water.

Their height above the ordinary stages of the river increases as we ascend, but still is subject to variations of several feet throughout. The depth of their highest points below the highest flood-stages, appeared to be more uniform; being ordinarily comprised between one and three feet, throughout the course of the river.

Thus at the mouth of the River Súcio, which I estimate at 61 miles above the mouth of Caño Coqúito, I found, by leveling, that the height of the greatest freshet known for 20 years, and which occurred in November and December, 1851, was $8\frac{1}{2}$ feet above the very low stage of water at the time we arrived at that point. Its marks were shown to us, and it had overtopped the highest portions of the levees 3 feet. Consequently, the levees were $5\frac{1}{2}$ feet above the same low stage of the river, which was as low as had been known for some 4 years.

At Vigía Curbaradór, about 96 miles above the mouth of Coqúito, the same freshet had risen about 10 feet above the same low stage; overtopping the highest levees about 2 feet.

Opposite the mouth of the Napipi, the highest points of the levees are 11 feet above very low stages of the river; and here I was shown the marks of the great flood of 1851, which proved to be 13 feet above a very low stage of water; and overtopped the highest parts of this levee some two feet. This point is 135 miles, (by my estimate,) above the mouth of Caño Coqúito. In Teváda, 149 miles above the mouth of Coqúito, the great flood of December, 1851, rose about 18 feet above the lowest stages of the river.

At Quibdó, (220 miles above the mouth of Coqúito,) from 12 to 15 feet above extreme low water, is quite a common occurrence; and the former may indeed be regarded as about the ordinary stage of the river at that place.

Approaching Quibdó, the levees are frequently full 20 to 22 feet above the lowest stages of the river, and are overtopped at times as much as 2 feet, which gives for the height of the greatest freshets about 24 feet above the lowest stages.

Above Quibdó, the levees gradually *decrease* in height, until near the head of canoe navigation they are but from 3 to 6 feet above the very beds of the streams.

The sides of the levees which front on the river are generally quite steep; but those on the land side, (or, more properly speaking, on the swamp side,) slope away gradually from the top.

The trees which grow on the levees are both larger and much more numerous than those in the swamps. In the latter they are frequently very sparse and stunted, amounting to mere shrubs.

It is manifest that but little space is available for the purposes of cultivation in the immediate vicinity of the river. Being confined almost

exclusively to the tops and land slopes of the levees, clearings rarely have a greater width than from thirty to fifty yards.

Until we ascend the Atrato as far as the mouth of the River Súcio, sixty-one miles above Boca Coqúito, not the slightest attempt at cultivation is seen, in consequence of the wet, spongy character of even the levees themselves. Indeed, the first huts to be met with are at the mouth of the Súcio.

Even above the Súcio, we saw but one or two of the meanest description, until we reached Vigía Curbaradór, which is ninety-six miles above Boca Coqúito. (See Plate IV.)

Above the Vigía they become much more numerous, several being frequently in sight at a time, each with its little patch of cultivated ground.

Plantains, yams, sugar-cane, and corn are the principal articles raised. To these may be added a few beans, tomatoes, red peppers, yuca, lemons, oranges, cacao, and rice. Scarcely a mouthful more is produced than will suffice for the bare subsistence of the occupants of the huts; so that considerable difficulty is frequently experienced by the boatmen in obtaining supplies during their trips along the river.

After ascending some 140 miles above Boca Coqúito, or five miles above the mouth of the Napipi, the monotony of the levees begins to be occasionally broken by low bluffs of stiff clay; and still higher up by bluffs of clay and pebbles.

Below that distance, I remember only the Cerro, or Hill of Tumaradór, twenty-three miles above Boca Coqúito; and the Loma, or Hill of Cacaríca, thirty-four miles above the same point.

The former is a small isolated cone, perhaps 100 feet high, on the east side of the river; and the latter a low range of about the same height, and some five miles long, on the west side. It, together with other ranges much higher, and to the west of it, we saw stretching away Northwardly towards the Carribean coast. Views of spurs of the Cordilleras frequently present themselves to the East. Many of them are striking, but none grand.

The elevated bluffs just mentioned are sometimes selected as sites for the erection of huts; but more generally these are built on the narrow summits of the levees, which are better adapted to the primitive processes of agriculture which prevail here, the soil being richer and more easily worked. The only farming implement employed is the machéte, or long knife, which answers in turn for axe, carving-knife, plough, fighting, grave-digging, and various purposes to which more complex machinery is adapted by other people.

The houses are necessarily placed on stilts, so as to be beyond the reach of floods; and their floors, which are thus raised from three to six feet above the summits of the levees, afford an excellent gauge for determining high-water-level.

During such floods as overtop the levees, and inundate all the back country for a great distance, not only the inhabitants, but also the dogs, hogs, and poultry take refuge in the huts, where they sometimes remain imprisoned for several days at a time.

Once, in the *dry* month of August, when Dr. Halsted and myself de-

scended the river, *from almost its very source*, to Quibdó, *all the levees throughout that distance were submerged by a flood*, and the huts resembled so many miniature arks, except that the unclean beasts greatly outnumbered the clean. (See Plate V.)

The material of which the levees are composed undergoes a gradual change as we ascend. Along the lower parts of the river it consists of soft mud mixed with leaves and logs; but further up, it by degrees, assumes a more firm consistency, until, on approaching the Napipi, it presents a soft, rich, loamy soil, filled with beds of dead leaves and logs. Still further up, it gradually acquires a clayey character, mixed with sand and gravel. The water of the swamps is continually seen percolating through the porous soil of the levees into the river, when the latter is low.

Neither a rock, nor a stone larger than common paving pebbles, is seen up to the very head of canoe navigation; nor, indeed, up to the low hill range which forms the line of partition between the waters of the Atrato and San Juan; and which itself consists of gold-bearing gravel and clay, without rock.

I should except a heap of small boulders, at the water's edge, on the East bank of the river, some thirty miles above Boca Coqúito. On the published maps these are marked "Pulgas," or "the Fleas." How they got there I cannot imagine. We passed on the opposite side of the river, and, consequently, did not examine them.

Widths and Depths of the Atrato, *between the Gulf of Darién and Quibdó.*—When once inside of the bocas, and above the shoal spots already spoken of in Caño Coqúito, there is a sufficient channel for steamboats drawing six feet water, as far as Quibdó, (or 220 miles,) for about 300 days in the year. The intervals at which the river is lower are very irregular, and continue from a day to a week or more at a time, depending on its constant fluctuations.

Up to the Vigía Curbaradór, ninety-six miles above Boca Coqúito, measured by the windings of the river, the width generally varies between 250 and 350 yards. In some few spots it is wider, and in others narrower.

Throughout this latter distance there is a channel of sufficient width and depth for the largest ocean steamers.

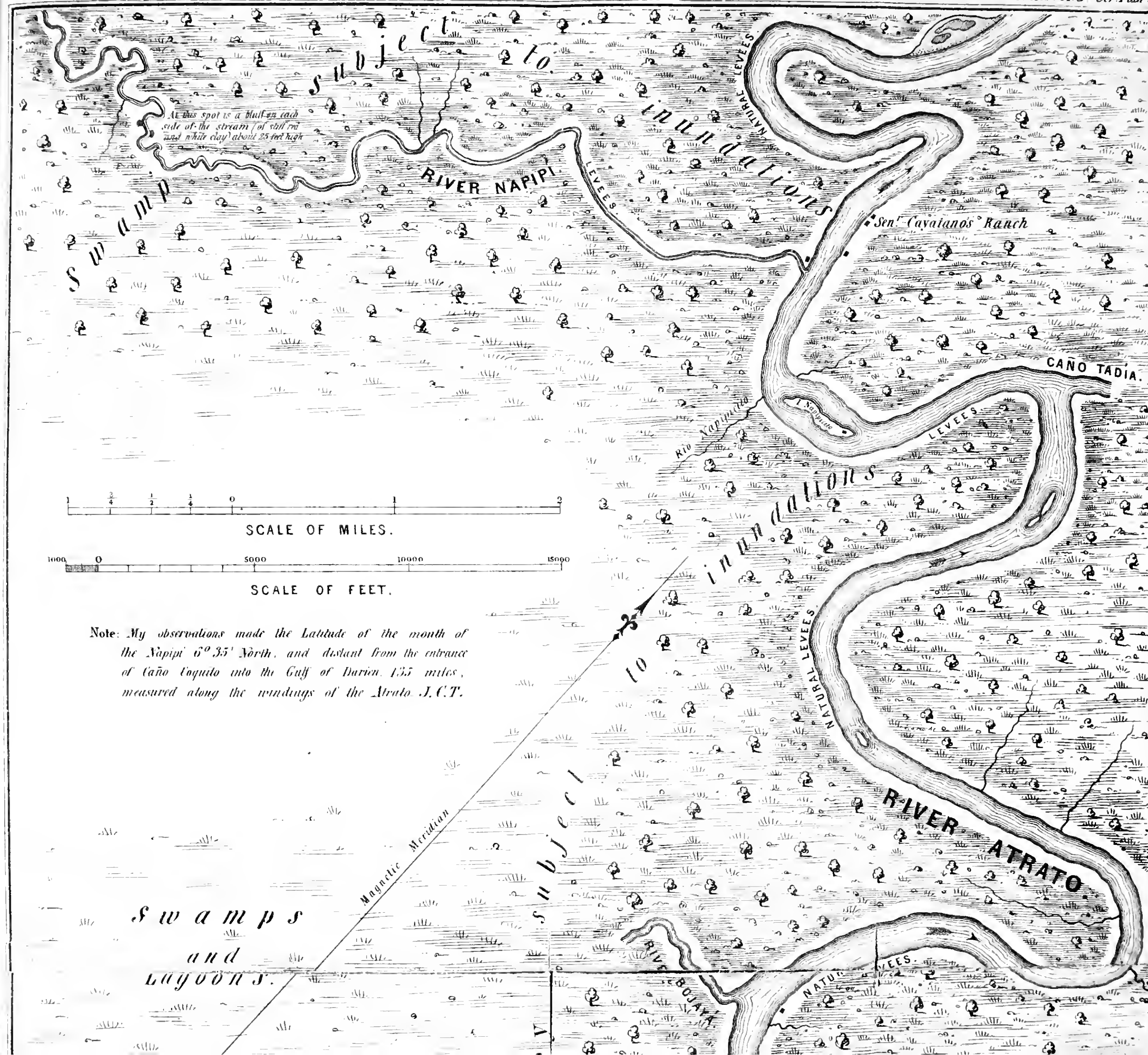
At the River Súcio, sixty-one miles above Boca Coqúito, I found the width to be 1050 feet, with a low-water channel-depth of fifty feet.

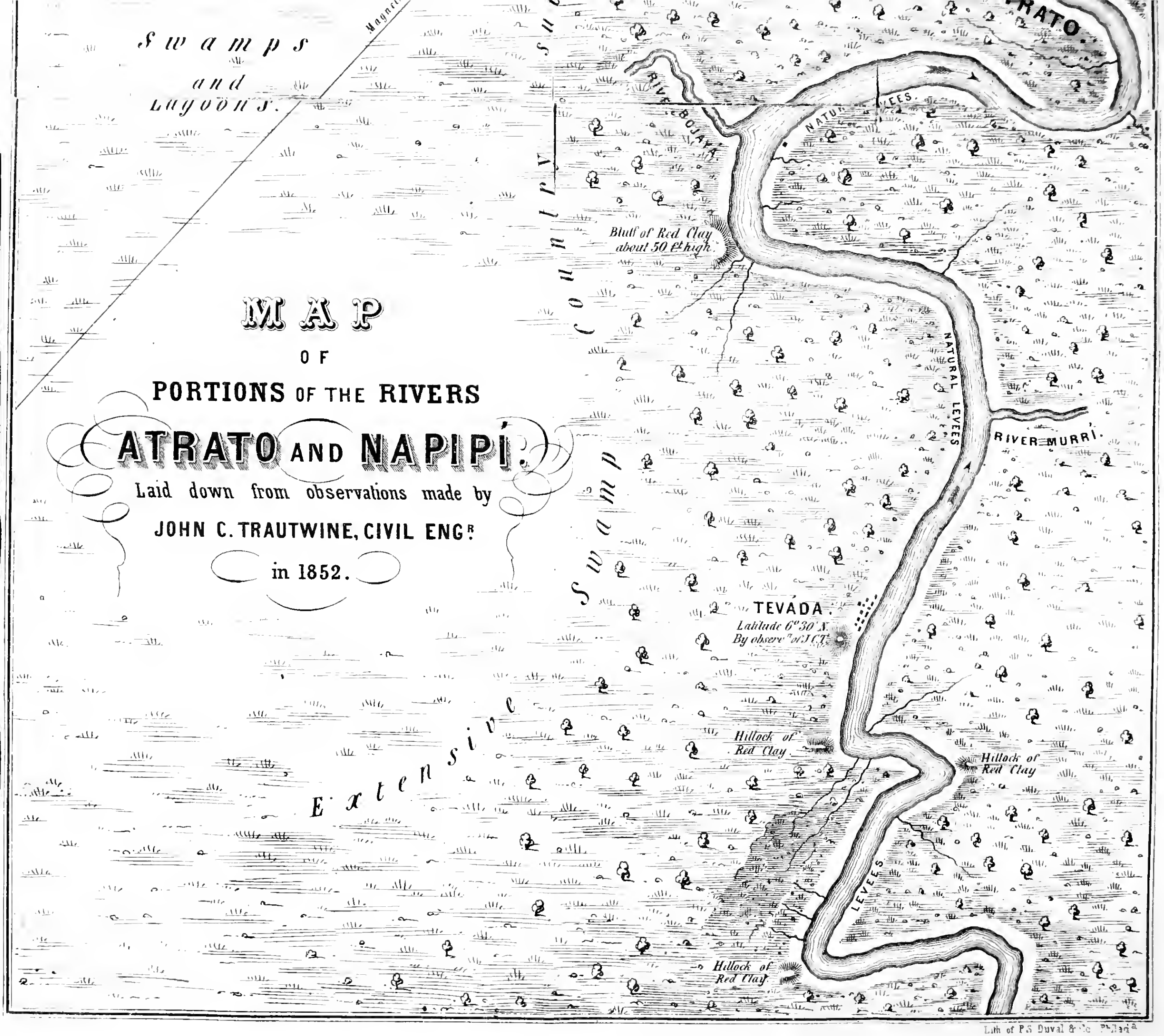
At seventy-five miles, the width was 950 feet—the low-water channel-depth, forty-five feet.

At Vigía Curbaradór, which I made latitude 7° 5' North, the width is 700 feet—the low-water channel-depth, thirty-six feet.

In many intermediate spots, I found depths of from sixty to seventy-five feet; and by following a more serpentine course, so as to hug the concave sides of bends, a steamer could carry forty feet, at low water, up to the Vigía.

For a few leagues above the confluence of Caño Coqúito and the Atrato, we had occasionally but forty feet soundings, in spots where the river was widest. I do not hesitate, therefore, to assert, that at the very


Swamp subject to inundations
At this spot is a bluff on each side of the stream (of stiff red and white clay) about 25 feet high
RIVER NAPIPI
LEVEES
NATURAL LEVEES
Senr. Cavaiano's Ranch
CAÑO TADIA.
I. Napipiato
Rio Napipiato
LEVEES.
subject to inundations
SCALE OF MILES.
SCALE OF FEET.
Note: My observations made the Latitude of the mouth of the Napipi 6° 35' North, and distant from the entrance of Caño Coquito into the Gulf of Darien 135 miles, measured along the windings of the Atrato. J. C. T.
NATURAL LEVEES
RIVER ATRATO
Magnetic Meridian
Swamps and Lagoons.
RIVER BOJAYA.
NATURAL LEVEES.



Lith of P.S. Duval & Co. Phila.

lowest stages of the Atrato, a perfectly safe channel-depth of at least thirty-five feet may be carried up to the Vigía.

In the foregoing channel-depths I have not always given the deepest soundings at each spot, but those which afford, at the same time, a width sufficient for the manœuvres of large river steamboats. They have been selected from a great number, merely to show the rate of gradual diminution of depth as we ascend.

It was generally impossible to measure base-lines on shore, for determining the widths of the river, on account of the soft deep mud and the dense vegetation at the water's edge, as well as from my unwillingness to cause any undue detention of the boat, which was loaded with merchandize for Quibdó.

To obviate this difficulty, I was frequently obliged to assume the length of our boat (sixty-eight feet) as a base-line. At every stop, whether for meals or other purposes, Dr. Halsted would perch himself at one extremity and I at the other, each with a pocket sextant in his hand, and at the same instant (in order to counteract any trifling motion in the boat) take angles to some well defined object (generally a sapling) on the opposite side.

Our instruments were capable of reading minutes; therefore I suspect that our widths are never in error more than ten or twenty feet. Whenever we could, we measured a base-line on shore. I mention this, (as I shall other expedients,) merely to enable the reader to attach what degree of confidence he may see fit to the results.

We also took soundings, by means of our canoe, (with a line, carefully adjusted every day,) whenever the boat stopped; as also whenever she crossed the river, in order to hug the convex sides of the bends, for the sake of the less rapid current. From Mr. McCann's expertness in this operation, it was generally performed by him, while I noted down the results.

The small canoe, which we constantly towed astern, was brought into requisition very frequently. Dr. Halsted availed himself of it for gathering plants; and all three of us would occasionally use it together for examining a few miles of some tributary of the main river. When quietly towing in our wake, it answered for bath and wash tub; and after we had ascended above Vigía Curbaradór, it was used for running out lines for pulling our large boat off from sunken trees, upon which she sometimes stuck fast, as we hugged the shore.

Below Quibdó these trees rarely extend out more than fifty feet from the banks; but, after ascending some leagues above that point, they appeared completely to cover the bottom of the stream.

After passing above the Vigía Curbaradór, a rapidly increasing shallowness is perceptible in the depth of the river, which at this point divides into two channels. These unite again about a league above the mouth of the Napipi, a distance of forty-two miles. The Western one is called the Atrato, and the Eastern one the Caño Tadía.

At both the upper and lower junctions, Tadía has but about half the width of the main stream. I saw no other portions of it, but was told that its depth was fully equal to that of the principal branch. The space which they enclose is called the Island of Tadía.

Commercially considered, the depth of the Atrato possesses interest, chiefly when regarded in connexion with the proposed inter-oceanic canal routes, by way of either the Napipi or the San Juan.

Therefore, in my further remarks respecting it, I shall be guided by that consideration only; and instead of presenting a long series of soundings, varying alternately from shallow to deep, and from deep to shallow, shall merely state the depths that may be carried from the Vigía to the mouth of the Napipi—to Quibdó—and from Quibdó to the point of partition between the waters of the Atrato and San Juan.

Although I myself consider the project of a ship canal through either of these routes to be a perfectly Quixotic conception, there are some who do not coincide with me in opinion; and with the sincere hope that their views may be the correct ones, I cheerfully contribute what little I can, to the data upon which the preliminary calculations must be based.

We carried a *very low stage* of water with us all the way from the bocas to near the mouth of the Napipi, as low as the patron of our boat had ever seen in twenty years, and his statement was confirmed by all the persons living along the river, whom I interrogated on the subject.

Ordinary stages of the river are distinctly indicated by a line along the levees, below which no grass grows. This line was from three to four feet above the water, as we approached the Napipi. While at this very low stage, the most serious impediment, or rather the least limiting depth that occurs between the Vigía and the mouth of the Napipi, is eighteen miles above the former. The width of the Atrato here expands to 1100 feet, and the greatest low-water depth is fifteen feet for a channel-width of 250 feet.

Only a mile above this spot, the river contracts to 500 feet in width, affording a low-water channel-depth of 25 feet; and in many places between the Vigía and the Napipi we had soundings of thirty-five feet. Still some two or three more places equally shallow with that just mentioned occur before reaching the Napipi; so that we may regard fifteen feet as the minimum channel-depth, at the lowest stages of the Atrato, that vessels would encounter between the ocean and the mouth of the Napipi, a distance of 135 miles.

It will be borne in mind, however, that these lowest stages are of rare occurrence and of short duration; and that, for the greater part of the year, eighteen feet might safely be assumed as the ordinary one.

I think it probable that the most effective proceeding for obtaining an increased depth would be to stop up the upper end of Caño Tadía, about three miles above the mouth of the Napipi, assisting this process by dredging.

The most sudden bend in the Atrato, below the mouth of the Napipi, is but a mile from the latter point. Even it, would allow the passage of river steamboats of the largest class. It is shown on the map, (Plate VI.)

At half a mile below the Napipi, the Atrato is 925 feet wide; immediately opposite that tributary it is 740 feet.

Near the bocas the current appeared to vary from about half a mile to nearly a mile per hour; but increasing gradually as we ascend, it be-

came nearly two miles per hour, (at the low stage,) near the Napipi, except in narrow spots, where it was sometimes three miles.

THE NAPIPI.—Having now reached the mouth of the Napipi, and pointed out the capabilities of the Atrato for navigation to that point, we will, for a short time, take leave of the latter, while we examine a few miles of the lower portion of the former.

The stipulations of my engagement did not embrace or even contemplate an exploration of the Napipi route to the Pacific; nor did I, when I left the United States, intend to devote my attention to it, fearing that I might thereby prolong my proper survey into the rainy season.

But on arriving at the spot, and learning that above Quibdó the rainy season occupies the entire year, I found it impossible to restrain my desire to take, at least, a hasty glance at the lower portions of the Napipi. I had seen no reliable description of that river, and wished to form some general idea of its capacities for the important purpose to which it is so generally supposed applicable.

I, therefore, made arrangements for detaining our large boat at the mouth, while I should ascend the river in our small canoe. From this course, however, I was dissuaded by Señor Cayatáno, a colored man, who resides about half a mile below its mouth. He owns extensive tracts of levee along this portion of the Atrato; and in his buildings, cultivation, and improvements generally, evinces a degree of intelligence and energy in striking contrast with the almost brutal apathy of his neighbors.

He assured me that it would be very difficult, if not impossible, to ascend the Napipi with a canoe and paddles; and kindly lent me a boat of his own, with three men to pole her. This boat was 39 feet long, three feet beam, and fifteen inches deep; made, like all the boats here, from a single log.

Dr. Halsted, Mr. McCann, myself, and the three bogas, together with a box of provisions, and a change of clothes, constituted our load. We sat off without any definite idea of when we should return. That would depend upon the character of the stream. Should it prove to be a really fine one, we should cross over to the Pacific; otherwise, we should return without doing so. We did return on the evening of the same day.

The mouth of the Napipi is, by my observations, in latitude 6° 35′ North; and 135 miles from Boca Coqúito by the windings of the river.

Its width is just 100 feet, as measured by our tape line. The low-water depth at the same place, taken at three equi-distant points twenty-five feet apart, is eight feet, five feet, and two feet; but at a short distance inside it is greater. The Atrato had risen, on the day of our arrival, four feet above the extreme low water stage with which we had ascended the river, therefore, the depths, as we actually found them, were twelve, nine, and six feet.

Whenever we stopped, even for an hour, a gauge-pole was instantly planted, so as to inform us, several times a day, of the rate at which the river was rising or falling.

This was the first rise we had had since leaving the gulf, and it subsided almost as rapidly as it had approached.

We ascended the Napipi but eight miles. Along this portion I took the bearings and distances, as accurately as I could, from the boat; and Plate VI. (map) exhibits a protraction of them, together with one of the Atrato from the Napipi to Teváda, also from my notes.

Throughout the eight miles which we examined, the width of the stream was pretty uniformly about seventy-five feet; and its depth, as we found it, twelve feet in the centre, six to nine feet on the convex sides of bends, and from fifteen to eighteen feet on the concave sides; being equal to a uniform depth of twelve feet. The depths were about equal throughout the eight miles; and are near the ordinary ones.

There was a current of a trifle more than two miles per hour at the upper end of the eight miles.

The levees are generally from four to five feet above the level of the water; and, like those of the lower parts of the Atrato, consist of soft mud, leaves and logs; though near the end of our observations they were becoming more firm.

The freshet-marks were throughout about two feet higher than the tops of the highest levees.

Bottom, mud, with an admixture of fine sand near the upper end. From the very mouth, we found the bed of the stream to be literally paved with sunken trees. In many places they nearly closed it, so that we had difficulty in getting our boat along. In some parts they formed rapids, along which we should scarcely have been able to force a short canoe by paddles only. We had four hours of pretty hard work in passing up the eight miles, even with poles.

About three miles up we noticed a short bluff on each side of the stream. They consisted of red and white clay, and were some twenty or twenty-five feet high.

The branches of trees growing on opposite sides frequently interlock overhead. Among them we saw a few monkeys and toucáns. We also smelt alligators two or three times, but did not see them.

Some of Señor Cayatano's men had several times crossed by this route to the Pacific. According to their statement, they generally occupied three days in poling up to near the head of the Napipi, and half a day more in walking from that point to the ocean. The whole distance, I was told, however, had been traversed within two and half days by persons in a hurry.

They likewise informed me that gravel showed itself within a day's boating above where we had reached; and that there also the first habitations and cultivation were met with.

When I turned back from ascending the Napipi, (although disappointed,) it was with a determination to revisit it on my return, and make a careful exploration of the entire route. But before completing my survey by way of the Atrato and San Juan, I had crossed to the waters of the Pacific, by three different paths, all of which had been represented as far preferable to that of the Napipi. On one of them especially, it was insisted that no shadow of difficulty presented itself. An eminent ecclesiastic even went so far as to state positively that I should find the point of partition to be but eighteen feet above the waters of the Atrato. Yet, on ascending the tributary so highly recom-

mended, for miles after it had become a roaring brook, I levelled up the aforesaid point of partition for some 500 feet, before putting away my level in despair; and climbed over the remainder in unspeakable disgust.

I had also found that the *canal* of Raspadúra, mentioned by Humboldt as having been made by a curate of Nóvita, and through which loaded canoes were said to have passed from the waters of the San Juan to those of the Atrato, was in reality a *hill*, across which canoes were dragged, as they now are, not only at that point, but at many others in this region. A canoe was so transported at one of the partition points at which I crossed, and at the same time.

There being no roads here, all traveling is done by canoes, which supply the place of the horse with us; with, however, the important difference, that in bad places the traveler carries the canoe, instead of the canoe carrying the traveler.

It may be readily imagined, that after proximity to the scene had so rudely dispelled the charm with which distance and false representation had invested it, my anxiety to explore additional routes was sadly diminished; and I may possibly be excused when having, for the second time, reached the shores of the Pacific by different paths, I preferred to turn my face homeward by way of Panama rather than toil for days up the San Juan, and again embark on the Atrato, to explore, at my own expense, other lines which I had every reason to believe were equally impracticable.

In the absence of positive information respecting the upper portions of the Napipi, and the point of partition near the Pacific, it would be sheer presumption in me to pronounce that route impracticable for a ship-canal. I may, however, be permitted to offer a few humble suggestions respecting the portion which came under my notice :

1st. The soil of which the levees and swamps along the lower portions of the Napipi consist, is open and porous, being composed in great part of beds of dead leaves, logs, and entire trees, the accumulations of ages. No material could be more entirely unfit for forming canal banks, especially for a ship-canal; or offer greater difficulty in the foundations of the locks, and other contingent constructions. All along the Atrato, we noticed the water from the swamps percolating through it, very often in full gushing streams.

2d. The entire region for *at least* twelve (very probably for more than twenty) miles along the stream, is liable to overflow, from one to three or four times a year. At these times it is submerged several feet, and the back-water does not drain off for some weeks, during which periods all work would have to be suspended. How are embankments to be made under these circumstances; or, admitting that they could be commenced, what precautions could be adopted for preventing their destruction by every overflow, while in an unfinished condition?

3d. Throughout the same extent back from the Atrato, more or less rain may be safely calculated on for nearly 300 days in the year, and in every week.

How would embankments of soft marsh-mud, and leaves, stand under the destructive influence of these rains?

Or, from what source could the earth be excavated for making embankments, when water would instantly fill the space from which each spade-full was removed?

4th. Stone and timber fit for construction are entirely wanting, and would have to be brought from considerable distances, at great expense.

5th. Even admitting, for the sake of argument, that laborers *could* be set to work on these marshes, I suspect that very few would live four months; or be able to render efficient service for more than as many weeks.

Now, in order to frame some extremely rude idea of the cost of constructing the Napipi route, let us endeavor to reduce a few of the more important items of expenditure into a somewhat tangible shape.*

Let us assume, for instance, that in a good working day, under all the disadvantages of swamp-miasma and a burning tropical sun, an ordinary laborer could excavate, and with wheelbarrows† form into embankment, three cubic yards of this marsh mud. We will suppose, also, that notwithstanding inundations and rains, he could work three days in the week, and that his cost to the company would be but $2·50 per day for every day, (including his passage to and from home, medical attendance, tools, expenses of pumping, bailing, &c.)

At this rate he would, in one week, excavate nine cubic yards, at an expense of $17·50, or about $2 per cubic yard.

Now, 300,000 cubic yards per mile is a moderate assumption for a ship canal, and gives us $600,000 per mile for excavation alone.

To this we may add, for locks, for coffer-dams, for the exorbitant salaries necessary to induce officers to live (or, rather, to die) in these infernal regions, for a line of steamers and sailing vessels, for buildings, roads, &c., fully $200,000 more per mile, making a total of $800,000 per mile.

Let us suppose the entire distance to be but thirty miles, and that the point of partition is a ridge two miles across, and rising 300 feet in the centre; also, that instead of making use of the Napipi, a straight line be cut, which I think would be the preferable plan, as it would shorten the canal to perhaps one-half its river length, and cost less.

Then we shall have, say—

Twenty miles, constructed through the Napipi swamps, at $800,000, - - - - - - - - - -	$16,000,000
Two miles of deep cutting, averaging 150 feet in depth, and containing 16,000,000 of cubic yards, at 50 cents,	8,000,000
Carried forward, - - - -	24,000,000

* The prices which I have assumed will, doubtless, appear exorbitant to most of my readers. But, in vindication of them, I will merely remark, that I was Chief Engineer of the Panama Railroad, for the first year of commencing its construction, and from the experience acquired there, I am perfectly convinced that they are *entirely too moderate for the locality of the Napipi route*. The Panama Railroad could have been constructed in the United States for $25,000 per mile; its actual cost will not fall much, if any, short of $125,000 per mile. The disproportion would be *much* greater on the Napipi canal.

My ideas respecting the probable mortality of the employees are based upon the same experience on the swamp portion of the Panama Road, and are by no means overwrought.

† Horses and carts could not be employed.

Brought forward, - - -	$24,000,000
Eight miles in better soil, and less unhealthy locality, at, say, $200,000, - - - - - - - -	1,600,000
Deepening the Atrato thirty-nine miles, to the Vigía Curbaradór, so as to secure a depth of twenty-five feet of channel-way, removing, say, 200,000 cubic yards per mile, on an average, at $1 per yard, including raising it over the levees and depositing it on their inland slopes,	7,800,000
Stopping up the upper end of Caño Tadia, so as to force its waters through the channel of the main river, -	1,000,000
Improvements at Boca Urabá, - - - - - -	1,000,000
	$35,400,000
Add, roughly, for interest on gradual expenditures during fifteen years of construction, - - - - - -	15,000,000
	$50,400,000

By this supposititious process, therefore, we arrive at the sum of fifty millions of dollars for the construction of the canal, a sum which I regard, however, as *totally inadequate for the purpose.*

Whether water could be obtained for filling it, even if it should be constructed, I cannot pretend to say, but regard it as extremely doubtful.

Were it as easy a matter to *raise* a few hundred millions of dollars as it is to *talk* about them, there would be no difficulty about water, inasmuch as that of the Atrato itself might be used for locking down into the Pacific.

I have coasted and boated along both sides of the region comprised between the Pacific Ocean, from Panama to Buena Ventura, on one side, and the Caribbean Sea, the Atrato, and the San Juan, on the other side; and have crossed it both at the site of the Panama Railroad, and at three other points more to the South. From all I could see, combined with all I have read on the subject, *I cannot entertain the slightest hope that a ship-canal will ever be found practicable across any part of it.* When I employ the word *practicable* it is meant in a practical sense.

From careful levellings (with a spirit level) at several points, I am confident that the fall of the Atrato, from the mouth of Napipi to Boca Coqúito, does not exceed 28 feet, or an average of about $2\frac{1}{2}$ inches to a mile.

The River Opogadó enters the Atrato from the West, thirteen miles below the Napipi. I ascended it for four miles. Its width at the mouth is 120 feet; at four miles above, it is 100 feet. Depth near the mouth, two fathoms, which it retains for more than two miles, gradually shoaling afterwards to eight feet at the end of the four miles. It is very crooked, and encumbered by sunken trees. The bottom is of mud, so stickey that we could scarcely detach the heavy lead of our sounding line. Current near the mouth, $1\frac{1}{2}$ mile per hour; at four miles up, two miles.

To be Continued.

On Railway Turntables. By Samuel Lloyd, Jun.*

[Paper read at the Institution of Mechanical Engineers.]

In the construction of turntables, three leading principles have been followed; either the bearing has been on the centre only, with no bearings at the circumference, or with bearings at the circumference and none at the centre; or a combination of these two modes has been adopted by allowing the weight to rest in part upon the centre, and in part upon the bearings or rollers at the circumference; this last construction has been most frequently adopted. Most of the turntables first laid down on railways were made to rest on fixed-rollers, for the sake of economy; but although fixed-roller turntables are the cheapest kind in first cost, and were much used on the first railways made, live-roller tables have been generally adopted latterly, from the greater ease with which they turn;—as in the fixed-roller turntable the weight bears on the axle of the roller, producing rubbing friction, but in the live-roller table it bears upon the circumference of the roller, producing only a rolling action without any rubbing friction except in the guiding ring. Some fixed-roller turntables have however of late been constructed with much larger rollers than those formerly used, which has the effect of perceptibly lessening the friction; but these tables seldom continue long in good working order, in consequence of the rollers *indenting* the top table. This is an objection to which all roller turntables are subject, but those with fixed rollers most especially, from the top table always resting upon the rollers in these in the same position, thus receiving the pressure always on the same points; and as the amount of surface in contact between them is very small (the whole amount of surface in contact between the surface of the rollers and the top table being not more than three square inches, if so much), the rollers soon wound the under surface of the top table, so that the latter becomes indented over every roller. As soon as this takes place, considerably more power has to be exerted to turn carriages upon them, as the resistance to be overcome is greatly increased by the whole weight having to by lifted out of each of the hollows formed from the above cause.

But in addition to the increase of friction occasioned by these indentations, they cause also great unsteadiness, making the table rock, and thus clatter and hammer against the rollers as each pair of wheels passes on and off its two opposite sides. This deteriorating action goes on to a greater or less extent in almost all roller tables, often occasioning the top to break, if it is not very strongly made; this rocking is often greatly increased, and occasionally entirely originates, from the centre being too tightly screwed down, so as to take the weight entirely off the rollers on one side of the table.

This defect has led to the construction of turntables with a centre pin that acts merely as a centre guide, without taking any weight. Turntables of this class, if made with radiating rollers, have the advantage of remaining very solid for a time after they are put in, but frequently this is not of long continuance, for all roller turntables are unsteady, if the rollers are not *all* correctly turned to the same diameter, and cottered or

*From the Civil Engineer and Architect's Journal, February, 1854.

screwed up exactly to the same distance from the centre; each roller being a portion of a cone, its outside diameter is greater than its inside, and if either of the rollers is screwed up too tightly, the table rides on it. This is sometimes occasioned after a few months' wear, by the pressure of the table top continually exerting a force tending to drive the rollers upon which it rests outwards, which is sure to be the effect if either of the nuts that screw them becomes slack. This pressure tending to force the rollers off the roller path, causes considerable friction against the guide ring at the boss of every roller, and is one cause of the heaviness with which even live-roller turntables work, causing railway laborers in goods stations, whenever they have the chance, to wrench them round by horse power.

In an improved construction of roller turntables extensively adopted, the weight of the table top is nearly counterbalanced by a weighted lever which constantly tends to lift the centre pin without actually doing so, making the table much easier to turn, by diminishing proportionately the pressure on the rollers; the rollers also are not fixed as in common turntables, but in an inclined position, with their upper surfaces level, for the purpose of preventing the level of the table top from being disturbed by the surge of carriages passing over. In some turntables the rollers have been made with rounded edges and level rolling paths, with the view of lessening the friction of turning, and increasing the steadiness of the table by resting it on a plane instead of a cone; but these rollers have not been found to be durable, and the roller path becomes worn hollow by them. A more successful plan for diminishing the friction has been the use of spherical balls instead of rollers, traveling round in a live ring, to prevent the balls from rolling off, but allowing them room to shift their position on the roller path as they move round, which prevents them from wearing the roller path into grooves; and as the balls travel in a circle, sometimes in one direction and sometimes in the contrary direction, they continually present a fresh portion of their surface for the bearing, which preserves them from being worn unequally.

There is one objection to these tables, but which applies still more strongly to roller turntables—namely, the extreme difficulty of turning them in frosty weather, when the dirt on the rollers and roller paths becomes frozen; horse power is then often required to stir them, or a fire has to be lighted to thaw the congealed mud collected on them.

Centre-bearing turntables are particularly free from this objection, and also from the one before referred to—namely, the bearing surface becoming indented, from the small extent of surface in contact with the rollers.

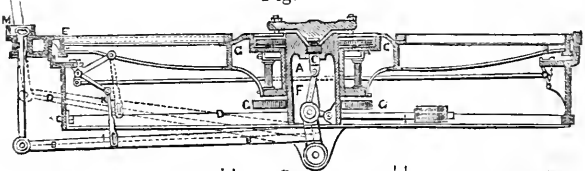
They also, as usually constructed, have most of them two defects—namely, great extra cost of foundations, and unsteadiness and liability to deflect; the last being the most serious defect, which renders them objectionable for any situation where much traffic is likely to pass over them. Their deflexion upon trains passing over them being caused by the whole of the weight of each carriage acting as a great leverage to strain the working parts of the table while running on and off.

The *unsteadiness* of the centre-bearing turntables described above may be considered as the principal cause of their disuse, notwithstanding

their superiority over roller tables in ease of turning; another cause being the expense and depth of the foundations requisite.

Figs. 1 and 2 show an improved mode of constructing turntables, by which the result is obtained of supporting the table top by its circumference when out of use, and upon its centre when in use. The action of the lever B, B, in this table, is to raise the table sufficiently to disengage the blocks H, H. When the table is not in use the lever is in the position showen at B, B, but as soon as it is necessary to turn a carriage, the table top is eased off the four blocks H, H, at the circumference, under the main-line rails, by being raised from $\frac{1}{4}$-inch to $\frac{3}{8}$-inch by the action of the knuckle joint lever F; by this time the stud I, which is fixed upon the long lever B, B, having traversed to the end of the slot in which it works, carries the rod K, with it; thus withdrawing the four blocks H, H, from under the outer ring E, E. The long lever is now at the position

Fig. 1.



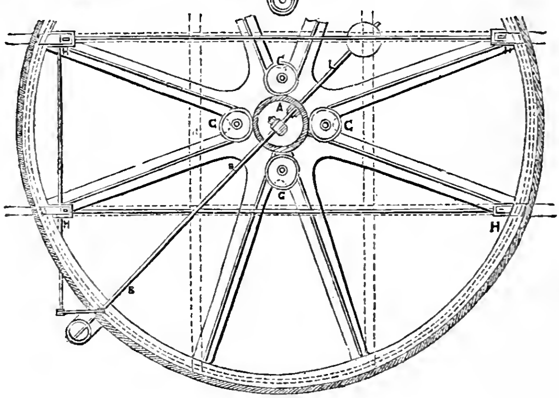


Fig. 2.

shown in the drawing, or at the bottom of its stroke; the centre joint of the knuckle joint lever F, has now passed from one side of the centre line of the table to the other. The table top is exactly at the same level when the long lever is at the bottom of its throw as when it is at its top; the difference being that when the long lever is up as shown by the dotted lines D, D, the table top is supported entirely at its circumference on the four blocks, which may be made of any convenient size; and while it is down the weight is on the centre pin C, when carriages may be turned with ease and rapidity. By means of the stud I, traversing the slot in the rod K, during the first part of the motion, the table top is eased off the bearing on the blocks H, H, before the rod K is set in motion to withdraw the blocks; and by the same means, in lowering the

table, time is allowed for the blocks to be pushed home before the table top is lowered upon them, so that the blocks are relieved from the weight whilst they are being moved. Fig. 2 is a plan of this turntable, showing the position of the long lever B, B, and the horizontal rollers G, G, that work around the centre pillar A. At the end of the lever L, a weight is fixed to balance the weight of the table top to within a few cwts.; the balance weight not being made heavy enough to raise the table top without the exertion of a slight pressure on the handle M. Other modifications of this improved table might be described, but as the principle in them all is the same, viz., to carry the weight on the centre pin when the table is being used, and upon the circumference when not in use, it is not necessary in the present paper to do so.

This mode of construction insures a *solid turntable*, one very *easy to turn*, and a very *durable* one; the working parts do not get deteriorated by the passing of trains, and are so placed that dirt cannot collect upon them; the extent of bearing surface at the circumference is greatly increased, and prevented from becoming indented as in roller tables; a smooth and easy motion is obtained by turning entirely upon the centre, as no inequality of bearing surface has to be overcome; also, less oil is consumed for the centre bearing than for rollers, and the working parts are more easily oiled. In roller tables an increased load increases greatly the resistance to turning, and after some years' wear they work more heavily; but in centre bearing tables much less difference is experienced. Also, the cost of foundation, instead of being more, is rather less than that required for roller turntables with a live ring and rollers, as a continuous ring of masonry is not required round the circumference, but only six or eight blocks of stone, one under each arm of the centre pillar, in addition to the centre stone, which is required in both descriptions of turntables.

Annual Report of the Engineer of the Philadelphia Gas Works.

TO THE TRUSTEES OF THE PHILADELPHIA GAS WORKS:

Gentlemen:—The Engineer respectfully presents to the Trustees of the Philadelphia Gas Works his Eighteenth Annual Report, detailing the operations of the Works for the year 1853.

In the quantity of Gas manufactured, there is an increase of thirty-three million cubic feet.

Considerable difficulty has been experienced in obtaining a sufficient supply of coals, in consequence of which it has been found necessary to buy varieties of inferior productiveness at high prices, whereby the yield of gas to the pound of coal will be diminished, and its cost much increased. In other respects the results obtained are as favorable as usual.

There has been manufactured during the year, two hundred and forty-nine million four hundred and twenty-seven thousand cubic feet of gas; making an aggregate production from the works of sixteen hundred and sixty-four million three hundred and forty-four thousand cubic feet.

The product for the year has been distributed in the following proportions to the different municipal sections, supplied from our Works.

	Cubic feet.
District of Southwark, . . .	10,458,200
Do Moyamensing, ...	5,810,700
Do West Philadelphia, . .	2,765,720
City, including what is used at the Works and offices, and loss by leakage, and opening of mains for connexions and service pipes,	230,392,380
	249,427,090

The maximum product of gas in twenty-four hours, was one million one hundred and thirty-seven thousand cubic feet.

The maximum consumption, one million three hundred and eighteen thousand feet.

For the manufacture of gas, the materials used in the year, are as shown in the following statement:

Coal in store January 1st, 1853, . .	454,101	Bushels.
" bought in 1853, . .	635,991	"
	1,090,092	"
Coal carbonized in 1853, . . .	779,628	"
" in store January 1st, 1854, . .	310,464	"
	1,090,092	"
Coke on hand January 1st, 1853, . .	123,000	"
" made in 1853, . . .	895,434	"
	1,018,434	"
Coke used under retorts, . . .	475,867	"
" " at New Works, . .	16,839	"
" " in Office and Yard, . .	7,140	"
" sold, . . .	513,588	"
Stock of coal on hand January 1, 1854, . .	5,000	"
	1,018,434	"
Rosin used, ...	134,327	Pounds.
Lime used in purifiers, . .	60,156	Bushels.

In the department of distribution, the additions to the service pipes and meters, have again surpassed those of any former year, and the increase in number of lights is also greater than has been experienced. The main pipes laid in streets have been as follows: two inch pipes, seven thousand one hundred and fifty-two feet; three inch, three thousand seven hundred and forty-four feet; four inch, three thousand seven hundred and eighty feet; six inch, four hundred and fourteen feet; sixteen inch, seven hundred and twenty feet; twenty inch, seven thousand two hundred and fifty-seven feet; total, twenty-three thousand and sixty-seven feet. The entire length of street gas mains is now six hundred and twenty-seven thousand two hundred and thirty-three feet, or one hundred and eighteen and three-quarter miles.

There have been one thousand three hundred and sixty-four service

pipes laid in new places, and the same number of new meters set; which, added to those before in use, make an aggregate of thirteen thousand and seventy-four services and meters.

Applications for gas have been registered to the number of three thousand two hundred and eighty, and the removals, and discontinuances are one thousand nine hundred and fifty-four; leaving one thousand three hundred and twenty-six as the increase of consumers, and making the whole number of consumers at this time, twelve thousand nine hundred and eighty-nine. The lights added are twenty-five thousand four hundred and thirty-two private, and eighty-eight public; also, twenty-three in Independence Square. The Districts of Southwark and Moyamensing, and West Philadelphia, report fifteen thousand six hundred and twenty-nine private, and four hundred and eighty-five public lights; which make a grand total of two hundred thousand eight hundred and forty-five supplied from our Works.

In one of the Western Public Squares, main pipes have been laid down by the direction of the Committee on City Property, but the gas has not yet been introduced.

By reason of the great increase of street mains and service pipes and meters the expenditures in this department have outrun the provisions heretofore made for it, to an extent that makes some further authoritative action a matter of imperative necessity. When in the year 1844 the Contingent Fund was devoted to the purpose of defraying the cost of the extensions of distribution, the number of services and meters required to meet the demands of new customers had averaged in the previous three or four years not quite three hundred and fifty per annum, and therefore the sum of thirty thousand dollars a year, to which the Contingent Fund was restricted, was deemed sufficient for this object. Since that period the annual applications for gas have become much more numerous, and particularly so since the recent large extension of the main pipes into all quarters of the City for the purpose of affording to every section the advantages of street lighting. The growth in this respect has exceeded all anticipations formed in regard to it, so that instead of the average of three hundred and fifty a year, on which the limitation of the Contingent Fund was based, the new services and meters furnished have increased to the large number of one thousand three hundred and sixty-four in the last year, and have averaged nearly one thousand two hundred and eighty the last three years. As a necessary consequence, the expenditures of this department have grown from the original estimate of thirty thousand dollars a year to over seventy-five thousand; and thus not only absorbed the whole of its own proper Fund, but have also encroached largely upon the resources designed for the enlargement of the Works and for Working Capital. All that can be derived from these sources is now exhausted, and the increase of street mains and service pipes and meters must therefore cease until funds are provided for their cost.

At the new Works in Passyunk, the principal structures are all roofed in and nearly completed; and as much progress has been made in fitting up the apparatus and its connexions as circumstances allowed. Much delay has arisen in the prosecution of this work from the unusual scarcity of

skilled laborers; and the difficulty from this cause was enhanced by the want of suitable dwellings for the accommodation of the workmen; in consequence of which it has been impossible to keep the desired force on the work; for in a season of unusually active employment, many workmen refuse to engage at a place so far distant from their residence; and it was found that skilful mechanics could be kept steadily employed, only by providing them with means of conveyance to and from their work, whereby much expense has been imposed on the Contractors and on the Gas Works.

The same difficulty of accommodations made it expedient to postpone the commencement of Gas Making Operations to the latest possible period: for the accomplishment of which it has been necessary to keep the Apparatus at the old Works in the highest state of efficiency attainable by the most vigilant daily inspection, and the prompt renewal of the parts exposed to destructive agencies, without waiting for the degree of dilapidation ordinarily admissible. By these means the supply of gas has been thus far maintained without recourse to the New Works, and it is believed it may be carried through the present winter unless some unforeseen disaster should occur to diminish materially their effective condition.

Should the question of the erection of dwelling-houses for the workmen be left in its present unsettled state, in which no authority is granted to the Trustees and no incentive is offered to individuals to undertake their construction, very serious inconvenience and much useless expense will be the probable result.

Very respectfully submitted, by

John C. Cresson, *Engineer.*

Philadelphia Gas Works, January 13th, 1854.

AMERICAN PATENTS.

List of American Patents which issued from February 7th, 1854, *to February 28th,* 1854, (*inclusive,*) *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

FEBRUARY 7.

1. For *Improvements in Rotary Engines;* Ebenezer Barrows, City of New York; patented in England, July 3, 1851.

Claim.—"I do not claim the sliding pistons, nor an abutment or stop in the steam channel or passage around the interior of the cylinder, irrespective of the manner in which they are arranged, and in which they operate; but I claim, 1st, the revolving steam wheel, having projecting rims or flanches, revolving within the interior of a stationary cylinder, in which there are two or more fixed abutments or stops, which fit steam-tight, so as to close and divide the annular space between the cylinder and wheel, into two or more steam chambers; the said steam wheel having four or more pistons whose operation is controlled by a stationary curved groove or way in each cylinder head, so as to be alternately acted upon by the steam in the cylinder, and down within the wheel, so as to pass and clear the abutments or stops, substantially in the manner shown. 2d, The six way cocks or steam heads, having each a steam passage leading to its plug seat, two steam passages leading from the plug seat to opposite chambers of the cylinder, two exhaust passages leading from opposite chambers of the cylinder back to the plug seat, and one

leading from the plug seat to the exhaust pipe, their cock plugs being provided with suitable openings and passages to make communication to or from the steam and exhaust pipes to either division of the cylinder, or to close both, substantially as explained. 3d, The mode of uniting the face and side packing pieces of the pistons and abutments, so as to make them steam-tight at their corners by dove-tailing them, as specified. I further claim making the steam cylinder within and a part of the piston wheel, the stationary rim forming the outer side of said cylinder, so that three sides of the said cylinder shall revolve with the pistons, substantially as set forth."

2. For an *Improvement in Dental Chairs;* A. Merritt Asay, Philadelphia, Pa.

Claim.—"What I claim is, moving the chair seat vertically, by means of screw, wheels, shafts, rack and arms, substantially as set forth."

3. For an *Improvement in Turning Lathes;* Edward Bancroft and William Sellers, Philadelphia, Pennsylvania.

Claim.—"What we claim is, the method of varying the motions of the mandrel, and screws or leader, by means of the two series of wheels, each series consisting of wheels of different diameters, and all the wheels of one series being connected and turning together, and imparting motion to all the wheels of the second series, with different degrees of velocity, substantially as described, when this is combined with the method of locking any one of the wheels of the second series with the shaft of the screw or leader, by having the wheels on separate sleeve arbors, fitted to turn on each other, and adapted to receive a locking pin or bolt, fitted to holes in a plate attached to the shaft of the screw, substantially as specified, or any arrangement effecting the same end by means substantially the same. We also claim the manner of supporting and sustaining the screw or leader by combining therewith, a trough, substantially as specified, having the outer end of the said screw or leader without a journal, as set forth."

4. For an *Improvement in Machines for Ruling Paper;* John and William McAdams, Boston, Massachusetts.

Claim.—"What we claim is, 1st, A machine for ruling paper, in which both the horizontal and vertical lines of the sheet are ruled in passing once through the machine, by any arrangement of devices which carries the sheet, after one set of lines is ruled, in a direction at right angles to its first course, to another set of pens, which rule the sheet across the lines first made. 2d, We claim changing the direction of the movement of the sheet after passing from the first set of pens, by means of the traveling band and revolving drums, as described. 3d, We claim lifting the pens so as to leave a heading to the sheet, by means of the roller with its movable tongue and cam projection, acted upon by the edge of the paper and the motion of the feed roll, so as to lift an adjustable arm connected to the pen holder, substantially as described. 4th, We claim forming grooves in the feed rolls so that the pens may rest over these grooves, and not upon the rolls between the passage of the different sheets, as set forth. 5th, We claim guiding the sheet straight to the second set of pens, after the direction of its movement is changed, by means of the converging bands, which carry the edge of the sheet against a proper guide, or against the side frame work of the machine, as specified. 6th, We claim forming the last roll which carries the sheet after it is ruled, to the receiver of a polygonal or angular shape, so that its revolution may give a vibratory motion to the sheet, for the purpose specified."

5. For an *Improvement in Machines for Making Nuts;* Jacob Reese, Sharon, Penna.

Claim.—"What I claim is, 1st, The use of the trough of cold water, in combination with the rotating die box, for the purpose of cooling each die or mould after it has discharged its nut, and preventing the water from coming in contact with other parts of the machine, or with the nuts which are made in it. 2d, I do not claim the rotating of the mould box, but I do claim the use of the guide head, constructed as described, in combination with the lever and guide, for the purpose of communicating to the rotating mould box the peculiar motion required, consisting of a succession of sudden, yet steady quarter revolutions, each followed by a pause or rest, during which the mould box is held firmly in its place, in the manner described."

6. For an *Improvement in Winnowers;* Michael Shimer, Union Township, Penna.

Claim.—"I do not claim the adjustable side alone; but what I do claim is, the movable side, in combination with the inclined screen, said combination subserving three purposes: 1st, For preventing the grain from passing over the edge of the screen until it has been

properly presented to the blast or draft. 2d, For partially cutting off the draft, as the state of the grain may require. 3d, For expanding the draft of the blast as it ascends the trunk, so as to weaken the force of the blast, in such a manner that the pure grain will not be carried over into the horizontal part of the trunk. 2d, I claim the square rubber, in combination with the circular flanch formed on its lower extremity, as described, for the purpose of mashing or grinding all impurities softer than the wheat, and also for preventing the grain from passing out of the bottom of the hopper before it has been thoroughly pulverized, as described."

7. For an *Improvement in Winnowers;* Josiah Turner and W. C. Sturoe, Sunapee, New Hampshire.

Claim.—"We do not claim the toothed cylinder or thresher, with its corresponding toothed concave; nor do we claim either of the devices described, separately; but we claim the combination of an oscillating cradle, of slanting slat or blind work, as set forth, with the two blowers and the fender, substantially in the manner and for the purpose set forth."

8. For an *Improvement in the Mode of Making Battery Connexion with an Electro-Magnetic Coil on the Traveling Carriage of a Telegraphic Register;* John M. Batchelder, Cambridge, and M. G. Farmer, Salem, Massachusetts.

Claim.—"We claim the combination of the system of progressive levers with the battery wires, the base board, and movable platform, so as to operate substantially as specified, and for the purpose set forth."

9. For an *Improved Machine for Polishing Plough Handles and other Articles;* Thos. Blanchard, Boston, Massachusetts.

Claim.—"I do not claim the invention of an endless polishing or smoothing belt; but what I do claim is, the mode of applying and operating said belt with respect to the article to be smoothed or polished, the same consisting in not only making the said belt to traverse or run on sustaining pulleys, or their equivalents, but at the same time to rotate such belt and sustaining contrivances in such manner around the article to be smoothed or polished, as to cause the belt, while in motion on its rollers, to run in contact with and around the surface or article to be reduced, smoothed, or polished. I also claim the combination of the feeding carriage, its guides, and the guide rollers, or the mechanical equivalents therefor, with the endless polishing belt provided with machinery for imparting to it its compound motion or movement in two directions, as specified."

10. For an *Improvement in Machines for Cleaning and Assorting Bristles;* George Edward Burt, Assignor to self and David C. Butterfield, Westford, Massachusetts.

Claim.—"What I claim is, the combination of machinery for combing or straightening the bristles, and machinery for separating or assorting them, as specified. I claim the combination of the two movable combs or rakes, and the two lifter wheels, and then carrying endless belts, and so arranged as described, the whole being for the purpose of first holding the mass of the bristles by one part or portion of it, and lifting and combing the remainder of it, and subsequently seizing and lifting it by such combed part or portion, and combing the part previously seized, all as specified. And, in combination with the machinery for combing or straightening the bristles, and machinery for assorting or separating them, I claim the endless guide belt, the spring band, and rapping apparatus or hammer, as applied and made to operate substantially in manner as specified. I do not claim the combination of an endless platform, roller, and a series of pressure rollers, as employed in the machine of Lorenzo D. Grosvenor; but what I do claim is the combination and arrangement of the two endless brush belts, and two series of draft rollers, and their two sets of endless bands, as made to operate together, and assort the bristles, substantially as specified. I claim the combination of the combs and their grooves with the delivery rollers, so as to operate substantially as specified."

11. For an *Improvement in Bit or Drill Holders;* Dexter H. Chamberlain, Boston, Mass.

Claim.—"I am aware that a hand drill has been constructed so as to have its drill shaft supported in a stock, and rotated by means of two beveled gears, one of them being fastened on the top of the drill, while the other was affixed on a separate shaft, disposed at right angles with the drill shaft, and having the crank applied so as to enable a person to rotate it, and thereby put the drill shaft in rotation; I therefore lay no claim to such a device. In the said drill stock, the crank of it is made to rotate in a plane parallel to the axis of the drill shaft; the consequence is, that during a rotation of the crank, there is an

uneven pressure exerted on the drill, the said pressure being increased at one moment, and diminished at another, and in the direction of the axis of the drill. A steady pressure on the drill, longitudinally as well as laterally, is desirable, particularly when a small drill is used, as without it the drill is not only liable to be broken or injured, but to be made to deviate in its desired course in passing through anything. The complication of the construction of the beveled gear bit stock, and the disadvantages incident to it while in use, render it an instrument of little value and utility. Neither do I claim making the tool stock and the bell crank in one piece of metal, so that their rotations may be equal and simultaneous; but what I do claim is, the arrangement of the bell crank separate from and so as to play or rotate within the tool shaft stock, substantially as specified, the said bell crank having a spur gear to work into a pinion fixed into the end of the tool shaft, and to impart to said tool shaft an accelerated motion, essentially as specified."

12. For an *Improvement in Tool Holders;* Dexter H. Chamberlain, Boston, Mass.

Claim.—"I do not claim a split or jaw socket having a screw and screw nut applied to it for the closing its jaws upon the shank of an awl or tool inserted between them; but what I do claim is, my improved method of arranging, constructing, and applying together the jaws and confining screws, the same consisting in making the jaws separate from the screw shank, (on which the screw is cut,) and in other respects substantially as described, and not only providing the screw nut with a closing concavity or socket, but the screw shank with a closing socket for the jaws to rest in, the whole being so that when the screw nut is screwed down upon the jaws, the combined action of the jaws and the screw nut shall operate to simultaneously close the jaws at their upper and lower ends, as specified."

13. For an *Improvement in the Manufacture of Tin Foil or Sheets;* John J. Crooke, City of New York.

"My invention consists in such improvement in the manufacture of tin foils or sheets, that by it I accomplish the reduction of the cost, though retaining those qualities which are essential to the purposes for which such foil or metal is required. This I effect by combining the baser and cheaper metal, lead, with the tin, not, however, in the form of an alloy, or mixture, but so that each metal will be kept perfectly distinct, the tin or superior metal being only exposed, while the lead or inferior metal is encased within."

Claim.—"What I claim is, the new article of manufacture described; that is to say, sheets or foils composed of tin and lead, formed in separate strata, but so that the exposed or external surface shall be pure tin only, for the purposes and substantially in the manner set forth."

14. For an *Improvement in Blocks for Horse Collars;* Lewis S. Davis, New Paris, O.

Claim.—"I do not claim the construction of a horse collar block in expanding sections; but I do claim the four parted collar block, of which the front pair of sections are hinged together at the gullet, and the back pair at the neck of the block, as described, the same being combined with a stationary bolt, placed at the intersection of the partings, the said bolt serving to unite the base and cap, and also forming a fixed bearing for the right and left hand screw, which, in conjunction with the pins on the block and the diverging grooves in the base and cap, effect the prolongation and proportional lateral expansion of the block or devices, substantially equivalent."

15. For an *Improvement in Omnibus Registers;* F. O. Deschamps, Philada., Pa.

Claim.—"What I claim is, 1st, Attaching the secret slide to the bolt of a lock, substantially as described, so that it can only be moved to expose or conceal the numerals on the dials, by a key which properly fits the lock. 2d, Combining the secret slide, with a stop bar, substantially as described, so that both move together in such a manner that when the apparatus is left free to work by the stop, the numerals on the concealed dials are not exposed, and when the numerals are exposed to view, the apparatus is made inoperative by the stop."

16. For an *Improvement in Tool Holders;* Elias Hall, Rutland, Vermont.

"My invention consists in adapting to a common handle, a shank, so contrived that any bit, or other tool of the kind, as a jointed file, screw driver, and the like, may be inserted with facility, and held perfectly firm while in use, and readily removed when another is to be employed."

Claim.—"I am aware that instruments somewhat similar have been used, and that this nearly resembles a bit stock; but in their construction, and especially in the application

of the spring, my invention is greatly superior; no other instrument of the kind has before been constructed so that it could be seen where the notch should be made upon the tool to receive the tooth of the spring; hence it has been found difficult to have every tool used in such an instrument firmly held, and it is only effected by repeated experiments and trials in making the notch; while in the instrument described, it can be seen at once exactly where the notch should be made so as to retain the tool when steadily and firmly held by the socket; besides, I am not aware that any such contrivance has ever been employed in an instrument to be held and used in one hand, or with a common handle. What I claim is, having a flat spring catch inserted in the side of the stock or handle, with an opening through the stock or handle, in a line with the catch of the spring, by which you are enabled to see and mark on the shank of the tool held, the point touched by the catch of the spring when the shank is pressed home in the socket, and thus readily mark the recess or notch in the shank."

17. For an *Improvement in Ploughs;* John S. Neall, Manchester, Pennsylvania.

"My invention consists in fixing the mould boards of either single or double ploughs on hinges, so as to be capable of being adjusted to any required width of furrow or crop to be cultivated, in so attaching the beam to the body of the plough by means of screw bolts that the point of the beam can be raised or lowered at pleasure, with great precision, so as to cut any required depth of furrow, in the manner of giving a nice lateral adjustment to the end of the beam by means of a set screw, so as to regulate the angle of the plough with the line of draft, in such way as to give land to the plough, or take it from it, and also in the mode of raising or lowering the points of draft of the plough, without altering the position of the beam."

Claim.—"What I claim is, the hinges, constructed in such a way that the edge of the front part of the mould board may lap over the edge of the back part or wing of the mould board, to prevent clogging."

18. For an *Improvement in Metallic Hubs;* J. B. Hayden, Easton, New York.

Claim.—"I do not claim the flanches, either with or without radial slots or recesses for the purpose of admitting the spokes; but what I do claim is, the disk, in combination with the recesses or 'saw cuts,' formed in the end of the spoke, into which disk is fitted, and acts to secure said spokes in a permanent position, and effectually prevent them from working in the hub, as described."

19. For an *Improved Machine for Dressing Spokes;* Ansel Merrell, New Bedford, Assignor to Ansel Merrell and John M. Irvine, Sharon, Pennsylvania.

Claim.—"What I claim is, the combination of the cam lever, having a screw thread thereon, with the adjustable dogs and supports, as herein set forth, whereby the rough stick or block may be held firmly at any required angle to the carriage, and at variable distance below the knives, in order that it may dress spokes of variable taper, and of different thicknesses."

20. For an *Improved Daguerreotype Plate Holder;* Reuben Knecht, Easton, Pa.

"The nature of my invention consists in providing two corners of the holder with two movable arms, which are projected by an eccentric wheel, turned by a swivel, and providing the holder with an oblong aperture for the shaft of the eccentric wheel to move to one side or the other, according as one or the other of the arms require a further projection."

Claim.—"What I claim is, the application of the eccentric wheel to the projection of the arms, or, which is effected by turning the swivel, which is firmly attached to the wheel aforesaid, in the direction of arrow 2, and the application of the oblong aperture to the projection of either arm, according as one or the other of the arms require a further projection, for the purposes described."

21. For an *Improvement in Sewing Birds;* Julius E. Merriman, Meriden, Conn.

Claim.—"What I claim is, employing, in connexion with a sewing bird, a spring tape measure, arranged in a case placed directly under the belly of the bird; the said case being so situated that it may have, if desired, a handsome pin or needle cushion placed on its top; this arrangement rendering the sewing bird capable of measuring as well as holding the cloth, while the sewing or measuring operations are being performed, and it also makes it more convenient for use, and ornamental in its design, as set forth."

22. For an *Improvement in Lime Kilns;* Clark D. Page, Rochester, New York.

Claim.—"What I claim is, the form, substantially as described, of the stack or cupola,

in combination with the arrangement of flues from the fire chambers for the introduction of the products of combustion at the lower end, substantially as specified, to insure the burning of the central part of the charge, as specified. I also claim cooling the calcined lime preparatory to drawing it out and exposing it to the atmosphere, by causing a current of cold air to pass through the saddle, or its equivalent, placed at the bottom of the stack, and on to which the calcined lime descends, as described."

23. For an *Improvement in Portable Door Locks;* Joseph W. Webb, Washington, District of Columbia.

Claim.—"What I claim is, the claws, in combination with the bar and thumb piece, constructed in the manner and for the purpose described."

24. For an *Improvement in Planing Machines;* James A. Woodbury, Winchester, Massachusetts.

Claim.—"What I claim is, 1st, The combination of the rotary disk cutter with the pressers and bed, substantially in the manner and for the purposes described. 2d, The combination of the bramah wheel, so called, with the rotating disk cutter and its accessories, for the purpose of planing, substantially as set forth."

FEBRUARY 14.

25. For an *Improvement in Picking and Cleaning Flax;* A. H. Caryl, Sandusky City, Ohio.

Claim.—"Although I have described the method of producing the currents of air required, I do not wish to be understood as limiting myself thereto, as the required currents may be obtained by other and equivalent means. Nor do I wish to limit myself to the special mode of construction of the other parts, so long as the same ends are obtained by equivalent means, in the combination specified. What I claim is, the employment of a picker having teeth hooked in the direction of the rotation, and arranged on separate bars, so connected with the shaft as to leave open spaces for the free passage of foreign substance, substantially as specified, when this is combined with hooked teeth, in a series of bars above, with open spaces between them, substantially as specified, with a current or currents of air, substantially as specified, to act on the fibres during the operation of combing, and with the rotating brush acting on the picker teeth, substantially as specified."

26. For an *Improved Arrangement of Vertical Tube Feed Water Heaters in Locomotive Smoke Stacks;* Matthias W. Baldwin and David Clark, Philadelphia, Pa.

Claim.—"We do not claim the employment of a heater for feed water, containing vertical tubular passages; but what we do claim is, the arrangement of the exhaust pipes, with a vertical central passage of large section and surrounding passages of smaller section, said central pipe and smaller passages being open above and below, in the manner and for the purpose substantially as described."

27. For an *Improvement in Machines for Cleaning Wool;* Lewis T. Chichester, Brooklyn, N. Y.

"The nature of my invention consists in making lateral, inclined, or curved slots, terminating in openings, circular or otherwise, smaller than the burrs, &c., in the edges of the ribs, so that the fibres which are caught by the picker teeth to be drawn through shall be guided by the lateral slots into the circular openings, and thus avoid cutting or chafing them, as would be the case if they were drawn through between the ribs and the teeth. Also, in making the said slots at or near that part of the length of the ribs where the picker teeth begin to leave the line of the ribs, and thus avoid all tendency to chafe and cut the fibres between the ribs and teeth. My invention also consists in uniting the contiguous barbs or points of any two ribs formed by the cutting of the lateral inclined slots, and extending them below the line of motion of the points of the picker teeth, to insure the carrying of all the fibres which are caught by the picker teeth into the lateral slots. And finally, in the employment of card or equivalent teeth between the rows of picker teeth, to catch and draw through such of the fibres as may have escaped from the picker teeth after being drawn into the lateral slots."

Claim.—"And although I have described and represented the form of the ribs, barbs, and picker teeth, I do not limit myself thereto, as this may be greatly varied without changing the principle or character of my invention. Nor do I limit myself to the use of a rotating brush for presenting or feeding the fibres to the ribs and picker teeth, as this makes no part of my invention, and can be done by other means. Nor do I limit myself

to the form, number, or manner of making or operating the teeth, as these may also be greatly varied and yet effect the same purpose; but what I do claim is, making the edges of the ribs, when combined with picker teeth for catching and drawing the fibres through, substantially as specified, with lateral, inclined or curved slots, terminating in an enlargement or hole to receive the fibres and guide them away laterally from the picker teeth, to prevent them from being chafed or cut between the teeth and ribs, substantially as specified. Also, making the lateral slots in the edges of the ribs, substantially as specified, and in combination with the picker teeth at or near the portion of the length of the ribs where the fibres begin to be drawn through, substantially as specified, whereby I effectually avoid the cutting of the fibres. And I also claim uniting the contiguous barbs of any two ribs, and extending them down below the points of the picker teeth, substantially as specified, to prevent fibres from passing without being picked or drawn through, as specified. And finally, I claim, in combination with the ribs having lateral slots, substantially as specified, the employment of card teeth interposed between the picker teeth, substantially as and for the purpose specified."

28. For an *Improvement in Valve Cocks;* John Griffiths, Philadelphia, Pa.

"The nature of my invention consists in making the valve with a cylindrical stem, passing through a hollow stem, which is attached rigidly to, or forms part of, the body of the cock, and is furnished outside with a screw, to which is fitted a nut, which carries a yoke, in which the valve stem is capable of turning freely, but not of moving longitudinally. By turning the nut the valve is raised and lowered from and to its seat, in a right line, the valve being always kept in such position that it will fall truly into its seat and close tightly."

Claim.—"What I claim is, the combination of the hollow fixed stem, the solid stem, and the yoked nut, substantially in the manner and for the purpose described."

29. For an *Improvement in Fire and Burglar Proof Safes;* F. C. Goffin, City of New York.

"The nature of my invention consists in filling the space between the two casings of a safe or vault door with glass or slag, when in a vitrified state, for the purpose of rendering the safe or door fire proof, and also proof against the efforts of burglars, glass being a poor conductor of heat, and so hard as to effectually prevent the operation of boring or drilling through the sides of the safe or door."

Claim.—"I do not claim forming safes or doors with double casing, for fire proof safes are at present constructed in that manner; but what I do claim is, the use of glass or slag in a vitrified state, for filling the space between the two casings of a safe or vault door, the glass or vitrified slag being poured molten into the space, or inserted in plates, which may be secured to the outer casing in any proper manner, and an air space left around the inner casing, as set forth."

30. For an *Improvement in Processes of Treating Vegetable Fibre;* Jonathan Knowles, Trenton, N. J.; patented in France April 4, 1853.

Claim.—"I am aware that Claussen has proposed to use, in his process, several of the salts I have mentioned, but in a different manner and with a different effect; but I make no claim to the use of any substance in any process such as he describes, nor in any other in which the bleaching and splitting of the fibre are effected separately. What I claim is, the method described of preparing vegetable fibre for picking, carding, spinning, and manufacturing into fabrics, by such machinery as is usually employed for performing the corresponding operations on ordinary cotton and wool, by first steeping or boiling it in a solution of alkali; second, washing it with water; third, steeping it in solution of chlorine bleaching compounds mixed with a solution of splitting salts, to bleach and split it simultaneously; and lastly, washing it with water and then drying it, as set forth, whereby the reduction of the fibre to its elementary filaments is expedited, and the expense thereof lessened by dispensing with much of the tedious manipulation and treatment heretofore practised, while, at the same time, the quality of the product is improved."

31. For *Improvements in Making Thick Paper;* Samuel G. Levis, Delaware Co., Pennsylvania.

"The nature of my improvement consists in an arrangement and combination of machinery for simultaneously forming two distinct fabrics of paper, and uniting them into one compound sheet by a continuous operation, and so that these component fabrics shall

be inseparably united; by this improvement, also, the thickness of the paper may be increased, and the strength and uniformity of the sheet of paper be preserved."

Claim.—"I do not desire to claim, generally, the employment of two forming cylinders, for the purpose of making paper of increased thickness, as cylinders have been thus used before; but what I claim is, the combination of the two forming cylinders, and the two endless felts, and the two squeeze rollers, arranged and operating in the manner and for the purpose substantially as described."

32. For an *Improvement in Fire Arms;* Thomas Cook, Assignor to Starkie Livesey, City of New York.

Claim—"What I claim is, 1st, Cutting slots in the tubes of the magazine, and with each tube a spring connected with a ring moving on the outside, for feeding up the spring and maintaining the compressed position given at the time of charging the tubes with ammunition, as described, whereby I am enabled to force such charge into the conveyor, by power independent of gravity, and to pierce the hole communicating with the powder, in the manner described; and this I claim, whether the feed ring be combined with a screw exteriorly placed or within the interior of the cluster of tubes, or whether the same effect be produced by or in any manner analogous. 2d, Combining the tube magazine with the conveyor, in such manner that it will be revolved so as to bring each tube of the series successively opposite to the hole through which the charge is fed to the conveyor, whenever and so often as a charge has been transferred to the barrel, in the manner described. 3d, The follower in combination with the cavity of the conveyor, and the lever for ejecting the charge into the barrel, as described. 4th, The cam groove in combination with the finger levers, and the cap case, to regulate the feed, as described."

33. For an *Improvement in Machines for Pegging Boots and Shoes;* John Standish, Assignor to Jno. Standish and Horace A. Miller, Cuyahoga Falls, Ohio.

Claim.—"What I claim is, 1st, The vibrating guides in combination with the peg-feeding rack, awl, and driver, as described. 2d, The arrangement for feeding up the boot or shoe to be pegged; that is to say, the combination of the boot or shoe, held in a proper clamp, with the traversing frames, and with the irregularly curved rails or guides, as described. 3d, The method of regulating the feed by the rack, pawls, and weight, or spring, as described, the whole being constructed and operating substantially in the manner set forth."

34. For an *Improvement in Drying Cloth;* Robert Preston, North Pownal, Vt.

Claim.—"I claim the arrangement for bringing the bottom layer of the cloth within the drying chamber, to a suitable distance from the bottom of the chamber, so that it may be exposed to a proper and not too intense heat, consisting of the rollers, which are adjustable by racks and pinions or their mechanical equivalents, substantially as described."

35. For an *Improvement in Ships' Ventilators;* Warren Robinson, New Haven, Conn.

Claim.—"I am aware that a patent was issued to Enoch Hidden, New York, dated June 21, 1853, for side lights and ventilators for ships; I therefore do not claim any part, or process, or other matter claimed by said Hidden; but what I claim is, the combination of the movable part with the two inclined planes, when the whole is constructed, arranged, and combined, substantially as described."

36. For an *Improvement in Hanging the Fore Plate to Iron Rolling Machinery;* Jacob Reese, Sharon, Penna.

Claim.—"What I claim is, not the scouring of rolls, as described, nor yet the coupling of the upper roll when the rolls are to be scoured, and uncoupling it when they are in use; but what I do claim is, the hanging the fore plate of a rolling mill on centres placed either above or below the level of the rolls, by adding arms to the fore plate, working on a bar or pivots, for the purpose of removing the fore plate out of the way when the rolls are to be scoured without detaching it from the frame of the mill, substantially in the manner described."

37. For an *Improvement in Planting Hoes;* W. G. Sterling, Bridgeport, Conn.

Claim.—"I do not claim the blade with a tubular handle attached, neither do I claim the opening and closing an orifice for the discharge of the grain; but what I claim is, the cylinder in connexion with the tubular handle, and the lever, with the sliding plate attached, as described, or any other mode equivalent thereto."

38. For *Improvements in Apparatus for Controlling the Pressure of Steam;* Henry S. Williams, Malta, Ohio.

Claim.—"I do not claim admitting water from a steam pump or 'doctor,' for the purpose of controlling the pressure of steam in boilers, when said water is let on and shut off by the agency of a float; neither do I claim causing an alarm to be sounded when the supply ceases or when the pump is not running, through the agency of a float and steam cylinders combined; but what I do claim is, 1st, Opening the water cock of the steam boiler for the purpose of letting on water for reducing the temperature and pressure of the steam, and thereby preventing explosions, by means of a plunger and slotted arm, arranged and combined in the manner described, and operated, when the supply should be let on, by the pressure of the escape steam of the safety valve, and by means of a spring attached to the boiler and slotted arm, when the supply is being shut off, the whole being constructed and combined in the manner specified. 2d, I claim starting the steam pump or doctor running, in case it should not be in operation when the pressure of the steam in the boiler rises above the given point, by means of the escape steam from the safety valve, when admitted to the steam chest of the pump, through a branch pipe of that carrying the plunger, said branch pipe being provided with a valve, which prevents the steam from the doctor passing into the boiler when the pump is running, but allows of the steam being admitted to the steam chest when the pump is not running, substantially as set forth."

39. For an *Improvement in Drop Bridges;* Jacob D. Woodruff, Newark, and Joshua H. Butterworth, Dover, N. J.

Claim.—"What we claim is, the construction of a bridge or draw, which may be dropped below the surface of the water, so as to admit the passage of vessels over the same, substantially as described."

40. For an *Improvement in Machines for making Links of Jack Chains;* Arcalous Wyckoff, Wellsburgh, N. Y.

Claim.—"What I claim is, the fixed stud pin, and stud pin, placed at right angles to each other, in combination with the wiper and cutter, and cutter operated in the manner set forth, for the purpose of bending the two eyes of the link of the jack chains simultaneously."

41. For an *Improvement in Gas Burners;* John Webster and Orson Spencer, Assignors to John Webster, Cleveland, Ohio.

Claim.—"What we claim is, affixing or applying to a gas burner an oblong or elliptical shaped tube, so constructed and arranged as to deflect a portion of the gas escaping from the burner into the draft of air which passes up between the burner and the tube, so as to produce a more brilliant flame and more light from a given quantity of gas, substantially as described."

42. For an *Improvement in Saddle Trees;* George B. Ambler, Trumbull, Conn.

Claim.—"What I claim is, the combination of the crooper loop in one piece with the water hook, for the purpose of securing either in their respective positions, without the aid of screws or other appendages than those set forth, and to be used in the manner substantially as described."

43. For an *Improvement in Water Closets;* Frederick H. Bartholomew, City of New York.

Claim.—"I do not claim the use of the chamber when combined with the supply pipe or hydraulic main and the basin, by means of the common three-way plug turning cock, operated by the seat, as such combination has been before used in the water closet of Jordan; nor do I claim the puppet valve cock, with two valves and three ways, as new in itself; but, 1st, I claim a three-way cock with parts constructed and combined in the following manner, viz: having one principal chamber through which the water always passes, whether being received or discharged, two openings into which chamber being governed by two valves, operated by one stem, so that when one is opened the other is closed by the same action of the stem, the third way being without a valve, when these are combined with a second chamber for the accommodation of a short continuation of the valve stem through which the cock is operated, and one of the ways is placed between the principal chamber and the stem chamber, as described. 2d, Placing such a cock as described under the seat, or where it may be out of the way, and may be operated by a single rod, when said cock is connected by a tube with a chamber for the reception and

discharge of water under pressure. 3d, I claim, in combination with the double valve, an eduction way, employable for the double purpose of wasting out the water remaining in the pipes above the cock when not in actual use, and through means of which or whereby a communication is provided with chamber, for the purpose of keeping it charged with air, by means of valve or otherwise, at the same time that the said way is closed by valve against the escape of water from the chamber while the seat is depressed."

44. For an *Improvement in Horse Bells;* Jason Barton, Middle Haddam, Conn.

Claim.—"I do not claim the employment or use of two clappers or balls in each bell, for they have been previously used; but what I claim is, hanging or suspending the tongues within the bells, in the manner substantially as described, viz: having the tongues placed over curved holders, which are attached to the pad, said holders being within the bells, and so arranged that the tongue may be placed over them at different points, and thereby be suspended in the centres of the bells, irrespective of the positions which the pad and bells may have when attached to the body of the animal."

45. For an *Improvement in Machinery for Paging Blank Books;* J. L. Burdick, City of New York.

Claim.—"I do not claim the screw on the shaft for moving the cylinder laterally; but what I claim is, 1st, The type holders, substantially as set forth, in combination with the vertical type cylinder, for the purposes specified. 2d, The use of the vertical sliding rod or frame, having a rack attached thereto, in combination with the double-acting crank shaft and levers for operating the printing hammers, or substantially the same device, for the purposes set forth; and also the combination of the rack with the lever and rod, for drawing out the type holders, or their equivalent devices, substantially as set forth. 3d, The use of the vertical sliding rod or frame, having a rack attached thereto, for working the distributing inking rollers, in combination with the tape-holding lever, or their equivalent devices, substantially for the purposes set forth. 4th, The use of the vertical sliding rod or frame, having a rod attached thereto, in combination with the lever for operating the type-inking rollers, or their equivalent devices. 5th, The use of the vertical sliding rod or frame, having an arm attached to the cap piece of the frame, in combination with the sliding plate, and lever, and pawl, or their equivalent devices, for the purposes substantially as set forth. 6th, The use of the adjustable table and clamps, for holding the book while paging, in combination with the paging apparatus."

46. For an *Improvement in Machines for Stuffing Horse Collars;* John W. Howell, New Paris, Ohio.

Claim.—"What I claim is, the construction of the hopper, with an adjustable grate or crib bottom, in combination with the piston, funnel, clamps, and lever acting thereon, substantially in the manner set forth."

47. For an *Improvement in Fire Arms;* Horace Smith and Daniel B. Wesson, Norwich, Conn.

Claim.—"We do not claim the employment of a carrier or slide for transferring the cartridge from the magazine to the barrel, nor the employment, in combination therewith, of a piston or slide to force the cartridge out of the carrier and into the barrel; nor do we claim the employment of a piston slide as a breach to the barrel, nor the firing by 'concussion' instead of 'percussion;' nor do we claim the employment of making or applying the percussion hammer, so as to strike on the rear end of such piston, (instead of directly against the cartridge or its priming,) and so that the priming at the front end of the slide shall be exploded by concussion produced by the percussion or blow of the hammer on the other end of it, as specified. But we do claim the arrangement and application of the percussion hammer, with respect to the breech slide and the trigger guard lever, so that the hammer may be moved and set to full cock by the pressure or back action of the slide, induced by the action of the trigger guard lever, as specified. We also claim the improvement of making the front end of the piston slide with a dove-tailed recess, or its equivalent, for the purpose of enabling the slide to seize the metal of the cartridge, as explained, and so that the refuse metal or cartridge may be withdrawn from the barrel by the piston slide when next retracted, and discharged by the upward movement of the carrier, all substantially as specified."

48. For an *Improved Machine for Scraping and Toothing Veneer;* Allen Goodman and Lyman Wheeler, Dana, Mass.

Claim.—"What we claim is, a machine for scraping and toothing veneer, which has a

large feeding bed roll, around a portion of which the veneer is bent and held, and a revolving cylinder with scraping or toothing tools or knives inclined back from the axis of the said cylinder, so as to have a scraping instead of a cutting position, substantially as described."

49. For an *Improvement in Ball Valves for Pumps;* Joel R. Bassett, Assignor to Caleb H. Williams, Cincinnati, Ohio.

Claim.—"What I claim is, the method of aiding and ensuring the operation of the ball valve, by means of an intervening or dividing ridge placed between the openings, and forming part of the semi-annular chamber, as described, by which the valve is made to seek and occupy its appropriate seat when acted on by the discharge water in one or the other directions."

FEBRUARY 21.

50. For an *Improved Method of Operating Saws;* F. T. Andrews, Georgetown, D. C.

Claim—"What I claim is, the method described, of communicating the advance and receding motion to the saw, as and for the purposes set forth. Also, the combination and arrangement of the half beam lever and rocking link with the saw, when operated by a crank, or its equivalent, and pitman, connected at any point between the fulcrum of said lever and the saw."

51. For an *Improvement in the Mode of Attaching Horse Bells to Straps;* Jason Barton, Middle Haddam, Connecticut.

Claim.—"What I claim is, attaching spherical bells to straps by means of wires or rods, the bells being attached to the wires or rods, as described, and the wires or rods secured in any proper manner to the other side of the strap."

52. For an *Improvement in Window Cord Pulleys;* Jeremy W. Bliss, Hartford, Conn.

Claim.—"I do not claim, separately, of itself, making the box part of the shell and its face piece in halves, and fitting together by angular tags and recesses, as specified; but I do claim the shell and its face piece, in halves, fitting loosely together, as described, when combined with the wedge-formed seat and projecting tooth, constructed and arranged as specified, so that the pulley may be fitted together and in its place, with despatch, and be readily removed and taken apart for the convenience of cleaning, repair, or adjustment of the cord, without detaching the latter, and whereby the shell, with its pulley, when in their place, cannot be moved outwards without raising the sash and its weight; fastening screws are dispensed with, the chafing of the cord avoided, and the entry and removal of the pulley facilitated, as specified. I further claim the combination and arrangement of the back locking bolt with the wedge-formed seat and projecting tooth, as described."

53. For an *Improved Curved Sash Bolt;* E. G. Connelly, Indianapolis, Indiana.

Claim.—"What I claim is, the combination of the gravitating catch or bolt with the metallic case or box, giving said catch the form of an annular segment, or the segment of ninety degrees of a circle, combined with said metallic case of similar form, constructed and applied in such a manner that the expansion of the wood cannot retard or obstruct said catch or bolt as it inserts itself into the recesses or notches in the frame. I do not claim the recesses, or the material of the metallic case, or the catch; but the construction, formation, and application of said metallic case and catch, substantially in the manner and for the purpose described."

54. For an *Improvement in Stone Picking Machines;* John T. Foster, Jersey City, N. J.

"The nature of my improvement consists in combining three or more or less series of rows of teeth with a cylinder, secured on the axle of the cart, on rods running lengthways of the cylinder, in such a way as to fall back and be concealed in the cylinder as they come in contact with the discharging plate, so as to prevent any liability to locking the cylinder by stones wedging underneath them when falling into the discharging trough, as is sometimes the case in my original machine, and in their dropping out again as they get to the underside of the cylinder to pick up the stones again, and in which position they are held by spurs on the end of the rods, working or running over a cam attached to the cart frame for that purpose."

Claim.—"What I claim is, the use of a cylinder for picking stone or other articles, in combination with series of rows of drop teeth, and cam and spurs for operating the same,

substantially as set forth. I also claim the use of the solid discharging plate, and its combination with the drop teeth in a cylinder, and operated substantially as set forth, and the combination of the drop teeth with the adjustable rake."

55. For an *Improvement in Oar Locks;* Wm. Perry Glading, City of New York.

Claim.—"What I claim is, the application to oars of a cylinder, surrounded with a band and bolt, as described, for preventing the oar from wearing off against the row lock, and preventing the oar from slipping out of its place."

56. For an *Improvement in Derricks;* John B. Holmes, Boston, Massachusetts.

Claim.—"What I claim is, 1st, The combined arrangement of the collar upon the mast, the revolving platform supported upon it, and clamped below it, and the tension rods from said platform to the revolving mast head cap, in the manner and for the purposes described. 2d, Pivoting the heel of the derrick boom upon the revolving platform in the locality, substantially such as described; that is, upon that portion of the platform which is beyond the centre of the platform when measuring from the point of suspension of the weight."

57. For an *Improvement in Stretching and Drying Cloth;* D. and H. Stearns, Pittsfield, Massachusetts.

Claim.—"What we claim is, 1st, The means for stretching the cloth while wet, and carrying the same parallel while being dried, consisting of the endless belt of tenter hooks traveling in adjustable ways to accommodate different widths of cloth, which ways are parallel to each other, except at the ends, where they converge to allow the cloth to be hooked on, and stretch the same as it is moved forward, as specified; and, in combination with the above parts for stretching the cloth, we claim converging the ways at the delivery end to relieve the strain on the cloth, and allow the same to pass off the tenter hooks without tearing, as specified. 2d, We claim the heating cylinder and its adjustable roller, so arranged as to keep the cloth in contact with any desired portion of the cylinder, to heat and partially dry the cloth the amount required before it is stretched on the tenter hooks, as described."

58. For an *Improvement in Weaving Wire Screens;* Joseph M. Schuyler and William Zern, Assignors to Daniel L. Easterly, Pottsville, Pennsylvania.

Claim.—"What we claim is, causing the warp and weft wires to bend each other by means of clamps, levelers, or their mechanical equivalents, operating upon the warp wires each time the lay beats up the weft, for the purposes set forth. We also claim connecting the lay and clamp movements, so that the motion of the lay shall give motion to the clamps, substantially as set forth."

59. For an *Improvement in Contrivances for Protecting Passengers in Railroad Cars;* Samuel F. Holbrook, Boston, Massachusetts.

Claim.—"I do not claim to support the back rest by inflexible bars hinged to the floor, and made to turn so as to bring the back from over one side of the seat to over the other side of it, in order to enable a person to sit in one direction, or the opposite, as may be most convenient to him; nor do I claim the placing in the partition of a carriage, and opposite to, and about the height of the face of a passenger, a broad band of padding extended from one side of the carriage to the other, and to serve as a protection to the head of the passenger in case of accident; but I claim, as applied to a railway car or carriage, the above described improvement for supporting the back and head rests, or either, viz: by means of strong flexible bands, or their equivalents, extended from or near to the floor, to or near to the roof of the car, substantially as specified. And, in combination with the flexible bands, I claim the set of slide rails, or equivalents therefor, made to support the bands at one end of each, and to allow of their being moved from their angular inclination from one side of the vertical to a similar angular inclination on the opposite side thereof, in manner and for the purpose as stated."

60. For an *Improved Tool for Dove-Tailing;* Amos P. Hughes, Philadelphia, Penna.

Claim.—"I am aware that the several parts described are old, and I do not, therefore, claim them; but what I do claim is, the arrrangement and combination of the chuck, bit, saw, and plane iron, or their equivalents, substantially in the manner and for the purposes as specified."

61. For an *Improvement in Corrugating Metal Plates;* Richard Montgomery, City of New York.

"My improved method of operation consists in passing a plate a number of times through a pair of grooved rolls, and a stationary crimping die, by which the folds of the beam are gradually brought to the proper depth without endangering the rupture of the metal, which is unavoidable when the corrugation of folds of any considerable depth is effected by rollers alone."

Claim.—"What I claim is, the method described, of forming corrugated metal beams by passing a plate of metal of the proper size through a series of grooves between rolls, and through a series of crimping dies, substantially as set forth."

62. For an *Improvement in Whiffle-Tree Hooks;* Martin Newman, 2d, and N. C. Whitcomb, Lanesboro', Pennsylvania, and G. C. Cole, Hartford, Connecticut.

"The nature of my invention consists of a metal socket, either brass or iron, or other metallic substance, so constructed that it will make a safe, convenient, and durable fastening for whiffle-trees, cock-eyes, draw-irons on axles, hold-back irons on shafts, neck yoke fastener; also, to attach to the end of wagon tongues. The socket terminates with a hook or loop, and is provided with a spring bolt or latch, turning or swinging on a centre pin, and latching in a recess or notch, in such a manner that the traces or other parts will be in no danger of becoming unhooked."

Claim.—"What we claim is, the construction of a trace fastener on the ends of a whiffle-tree, consisting of a swing latch turning on a pin, detents and spring, in combination with a hook and catch, or detent thereon, operating in the manner and for the purpose of preventing the accidental displacement of the cock-eye on the end of the trace. We do not confine our claim to the use of the socket, in connexion with the spring latch arrangement, as the spring latch and hook may be used either on a socket, plate, or shank, as occasion may require, or in any other manner substantially as set forth."

63. For an *Improvement in Attaching Hubs to Axles;* Elnathan Sampson, Claremont, New Hampshire.

Claim.—"What I claim is, the united band and tube, secured to the inner end of the hub, combined with the tube and the axle by means of the single screw, in such a manner as to securely confine the hub to the axle, and also exclude the dust from, and retain the oil within the hub, substantially as set forth."

64. For an *Improved Machine for Slitting Clothes Pins;* John B. Smith, Sunapee, New Hampshire.

Claim.—"I claim the sliding saw frame or frames, operated on adjustable ways, in combination with the movable 'groove bed,' as described. I claim the grooved or fluted bed, whether said grooves are parallel with the shaft on which said bed is placed, or radiate from its centre. I claim the manner of setting off the 'groove bed,' by means of a ratchet, as shown, or its equivalent, a worm wheel operating on the nubs of the index; these nubs being the same in number as the grooves in the groove bed. I claim the lever paws, operated by springs, or their mechanical equivalents, pressure rolls to hold the pin while being slitted. I claim the application of the gauging spring for driving the approaching pin towards the end of the groove into which it has fallen. I claim the safety slide for the purpose of preventing the wrong passage of the saws; in short, I claim the construction of a self-acting machine for slitting clothes pins by means of one or more saws making one or more earths into the same or separate pins, at one advance of the saws, having the same appurtenances, and operated substantially in the manner set forth."

65. For an *Improvement in Seal Presses;* James Foster, Jr., Cincinnati, Ohio.

Claim.—"I do not claim substituting percussion force for pressure, in presses generally, nor even in seal presses; nor do I claim returning the piston or die of a press with a spring; but I do claim the combination of the following elements, or their equivalents, to wit: a frame work to sustain the boxes and guides for the piston, a spring piston bearing the die and surmounted by a knob, or suitable provision for receiving the blow of the hand, and guided by the groove and guide pieces, or their equivalents, substantially in the manner and for the purpose set forth."

66. For an *Improvement in Treating Hair for Weaving;* John Gledhill, City of N. Y.

"The nature of my invention consists in raising a bulb or knob on either side of the hair, by heat or chemical agency, for the purpose of preventing the hair slipping from the notched hook or other device by which it is wholly or partly drawn out from the bunch

and served to the loom, and insuring its being properly caught and held as long as is necessary."

Claim.—"What I claim is, preparing hair for being woven into cloth by raising a bulb or knob at either end, substantially as described, whether by the action of heat, or by any chemical agent, whereby the hair is made capable of being readily seized, and as readily relinquished, by a device which serves it to the operating parts of the loom."

67. For an *Improved Machine for Cutting Laths;* Chas. F. Packard, Greenwich, Conn.

Claim.—"I do not claim, separately, the knife working vertically. for that is well known; neither do I claim the toggle joint for working the cutters, for that is a well known device; but what I claim is, cutting laths from a log or block by means of the knife or cutter, having a vertical reciprocating motion, and the knives or cutters having a horizontal reciprocating motion, the cutters being arranged and operating substantially as described."

68. For an *Improvement in Spooling Yarn from the Cop;* Smith Thompson, Newburyport, Massachusetts.

Claim.—"I claim the regulator guide, as combined with the friction beam, and made to hang on the yarn, and be capable of being raised by it, substantially in manner and for the purpose as specified."

69. For an *Improvement in Threshers and Separators of Grain;* John Zink, Greensville, Virginia.

"The nature of my invention consists in the arrangement of the straw carrier and apron on the same shaking frame with the screen, so that the same motion which shakes out the grain from the straw, and carries the latter forward and out of the machine, shall also carry forward, on said apron, the grain to the screens and blast."

Claim.—"What I claim is, the arrangement of the straw carrier and apron on the same shaking frame with the screen, so that the same motion which shakes out the grain from the straw, and carries the latter forward and out of the machine, shall also carry forward on said apron the grain to the screens and blast, as described."

70. For an *Improvement in Machinery for Making Cordage;* Rufus Porter, Washington, D. C., Assignor to George Stephenson, Northfield, Indiana.

Claim.—"What I claim is, the arrangement, substantially as described, and the combination of the flyers, rollers, and drum, by which the longitudinal motions of the strands between the flyers and the laying point are equalized, the said rollers being made to rotate on their respective axles by the tension of the rope and strands."

71. For an *Improvement in Parti-Coloring Machines;* Solomon Smith, Assignor to himself and Wm. Schoaler, Acton, Massachusetts.

Claim.—"I claim dividing each of the horizontal layers or frames into two sections, and carrying the cloth from the lower to the upper sides of such sections between the contiguous inner ends of said sections. And, in combination with the said mode of using sections and carrying the cloth between them, I claim the improvement of making the end of one section lap by that of the other, so that the same contrivances used to compress the several frames together, or down upon one another, may also operate to compress the two sections together, and upon the cloth extending between them, as specified."

72. For an *Improvement in Applying Colors to Stone;* Hiram Tucker, Cambridgeport, Assignor to himself and Joseph Storey, Boston, Massachusetts; patented in England, September 24, 1852.

Claim.—"I do not claim the common process of applying water colors to paper by the use of a bath of size, and mixing such colors in water; nor do I claim the union of linseed oil and varnish made from kauri, in its use in connexion with a pigment, and in the common process of painting or spreading colors on a surface by means of a brush, my invention having special reference to the application of colors to a surface by means of a liquid or water bath; nor do I claim therein the use of either kauri, or oil alone; what I claim in the process of marbling, whereby an oil color, (or pigment mixed with a drying oil,) when applied to, or spread on the surface of a bath of water, or other suitable liquid, shall have imparted to it the property above mentioned; such improvement consisting in employing in such process the gum kauri, (or a like substance,) combined, as specified, with the drying oil, the same enabling a person, by means of a bath, to apply to a surface of stone, or other material, oil colors, so as to present the natural effects or appearance of any polished stone it may be desired to imitate."

FEBRUARY 28.

73. For an *Improvement in Scythe Fastenings;* S. B. Batchelor, Lowville, N. York.

Claim.—"What I claim is, the continuous rectangular slot or opening, in combination with the ring and screw, by which I am enabled to attach any common scythe to my snath, as herein set forth."

74. For an *Improved Machine for Splitting Hoops;* John W. Chittenden and Wm. C. Mead, Vevay, Indiana.

Claim.—"What we claim is, the feed rollers, the griping anvil, and bending rollers, or their equivalents, arranged and constructed substantially as described, in combination with a trip hammer, as described, for the purpose of racking or splitting apart timber for hoops."

75. For an *Improvement in Salt Kilns;* John P. Couger, Newark, New Jersey.

"The nature of my improvement consists in the construction of a kiln with small fires at each end, so as to apply the fire near to the boilers, having but a short arch over each fire, and conducting the flues immediately to the kettles."

Claim.—"I am aware that tubes have been used for the purpose of heating water for other purposes; therefore, I do not claim the invention of tubes; but the application of them to the making of salt, I believe, has never been made before; and by means of my new kiln I am able to make more in any given time, and with a vast deal less amount of fuel. What I claim is, the arrangement of a salt kiln having two small fires, with short arches over the grates at each end, and the flues thereof meeting in the middle of the kiln, and passing into tubes leading through the feed trough placed immediately above and along the kiln, in the manner and for the purposes set forth."

76. For an *Improvement in Seed Planters;* Lewis W. Colver, Louisville, Kentucky.

"The nature of my invention consists in so combining a pulverizer or cultivator with a seed planter, as that the soil shall be mellowed up, the furrow opened, the seed dropped therein and covered over, at one and the same operation."

Claim.—"What I claim is, the combination of the loosely hinged stocks with the teeth and shoes, and a seeding apparatus, substantially as described, and for the purpose of mellowing the soil, opening the furrows, dropping and covering the seed at one operation, as set forth."

77. For an *Improvement in Churns;* Robert W. Davis, Rodgersville, New York.

Claim.—"What I claim is, the manner described, of dividing the end pieces and hanging them eccentric to the axis of the dasher, in combination with the arrangement of the blades, so that the dasher may be adjusted by the resistance of the cream in revolving through it, so as to present six centripetal cutting or agitating blades to the cream; and then after the butter is produced, to be adjusted by reversing the motion of the dasher, and through the resistance of the butter, so as to present but two centrifugal gathering blades for gathering the butter, working it into rolls, and expelling the buttermilk therefrom, substantially as described."

78. For an *Improvement in Machines for Pulverizing Ores;* A. K. Eaton, City of N. Y.

Claim.—"What I claim is, a rotating dish or mortar, to hold the ore to be pulverized, and the water, mercury, or other liquids with which it may be advisable to mix the same, in combination with a vibrating rubber or pestle, which is made to traverse the bottom of the mortar, substantially as set forth."

79. For an *Improvement in Snow Ploughs for Railroads;* Abijah Hall and Sylvanus Sturtevant, South Paris, Maine.

Claim.—"What we claim is, so shaping, proportioning, and placing the notched shares of the snow ploughs that they will extend down within the inner sides of the rails, nearly to the cross-ties, without coming in contact with the chairs, for the purpose of removing snow and ice from the immediate vicinity of the inner sides of the rails, and, by means of their mould boards, discharging the same at a proper distance outside of the rails, substantially in the manner set forth."

80. For an *Improvement in Dies for Making Seamless Metal Tubes;* Timothy D. Jackson, City of New York.

Claim.—"What I claim is, a die for drawing seamless metal tubes, constructed with an eye, whose periphery is formed of a series of narrow friction rolls, which produce a

substantially equable extension of every part of the circumference of the tube being drawn, as set forth."

81. For an *Improvement in Quartz Crushers;* Smith W. Bullock, Assignor to Stillman, Allen & Co., City of New York.

Claim.—"I claim the application of gear wheels, solely for the purpose of causing the crushing wheels to turn on their axes faster (or make more revolutions) than they otherwise would in rolling around in the trough, the point of contact (or pitch line) of said gear wheels being on a line drawn from their common centre to a point upon the crushing wheels within its outer diameter, (or periphery,) thereby giving the periphery a slip or sliding motion upon the quartz."

82. For an *Improvement in Railroad Chair Machines;* Michael M. Gray, Phila. Pa.

"The nature of my invention consists in the manner of causing a series of punches, knives, and dies, and a former and its base, to operate upon a heated plate of malleable iron, so as to pierce, cut, and compress the same into the form of a railway chair in a better manner than before known."

Claim.—" What I claim is, operating the sliding former or mandrel upon the base or pedestal, to keep it firm and cool, and cutting, curling, and swedging the plates of metal to be formed into the chairs while in a stationary position, and at a proper heat, on the top of this sliding former, instantly, in the manner and by the means as described, to produce the chairs uniform in shape, and cheaply, of low priced or red short iron, without fracture."

83. For an *Improvement in Seed Planters;* Thomas D. Henson and George Rohr, Charlestown, Virginia.

Claim.—"What we claim is, the construction, use, and application of a revolving longitudinal shaft, having series of right and left, or double obliquely set beaters, and cleaning spikes, for the purpose as specified."

84. For an *Improvement in the Use of Fusible Disks in Steam Boilers;* Wm. Burnett and John Absterdam, Boston, Massachusetts.

"The nature of our invention consists in inserting in a steam boiler, at a point below the proper water line, and above all the heating surfaces, a pipe, which, at a suitable distance from said boiler, is stopped up by a plate of fusible metal, or other fusible compound, it being so arranged that by freely exposing said pipe to the atmosphere, the water contained therein shall have its temperature so far reduced by radiation as to preserve, in a solid state, a fusible metal that will be easily melted by the temperature of the steam in the boiler when the water level shall have fallen so low as to admit said steam into said pipe."

Claim.—"What we claim is, placing in a pipe which is connected with a steam boiler, a fusible plug or disk, said plug or disk being so far removed from said boiler, but so connected with the water therein, that when the water is sufficiently high, the plug or disk will be in contact, or so surrounded with water cooler than that in the boiler as to prevent it from being fused; but when the water in the boiler shall fall below a proper height, the steam will enter and come in contact with said plug, or so surround it as to cause it to melt, the same being for the purpose specified."

85. For an *Improvement in Zinc White Furnaces;* James Renton, Newark, N. J.

Claim.—"I do not claim to have invented any mode of treating the oxides, or other substances, after they are evaporated; but what I do claim is, 1st, The combination of any number of ore tubes, and tubes or spaces, placed side by side, and communicating with each other through openings in their sides, the ore tubes being exposed to a degree of heat sufficient to evaporate the oxides, or other substances contained therein, and make them pass through the openings into the tubes or spaces, the said tubes or spaces being protected from the heat by the ore tubes, and serving either to collect and condense the oxides, or other vapors, or to convey them to any other suitable receptacle, substantially as set forth. 2d, The hood or trunk, furnished with suitable openings for the admission of air, and placed over the air tubes, and tubes or spaces, for the purpose of receiving, leading off, and cooling, the oxides or other vapors escaping from the ores, substantially as described."

86. For a *Table to Hold Bank Notes when Cut;* Frank G. Johnson, Brooklyn, N. Y.

Claim.—"I do not claim the movable cutting board; neither do I claim the depressable

needle screws; but what I do claim is, the combination with a table of the movable cutting board, and the depressable needle screws, combined together, in the manner substantially as specified, for the purpose of cutting bank notes."

87. For *Improvements in Air Engines;* A. S. Lyman, City of New York.

Claim.—"What I claim is, 1st, The mode of preventing the waste of the compressed air, liquid carbonic acid, or other driving power, by interposing between it and the outer cylinder of the engine, a reservoir of water, or other suitable liquid, substantially in the manner described. 2d, The mode of applying the heat to the generating power through the agency of water, or other liquid, in the manner substantially as specified; thus avoiding the possibility of burning and scaling the metal, and also greatly increasing the extent of heating surface. 3d, The mode of preventing the loss of power otherwise caused by the expansion of the air, liquid carbonic acid, or other driving power, in passing through the repository and refrigerator, and being cooled and condensed before the working piston has completed its stroke, in the manner described; that is, by moving the generating plunger downwards as the working piston recedes from it, thus enlarging the heating chambers as fast as the air or other fluid expands. 4th, The combination of the generating cylinders with the opposite ends of the working cylinder direct, thus dispensing with contracted passages and pipes, causing the piston to move as rapidly as the working fluid moves. 5th, The construction of the heat repositories and restorers of small glass tubes, or glass rods, arranged substantially as described, for the purposes specified. 6th, The combination of the heater, the repository, and the cooler, substantially as described; the heater being above the repository, and the cooler below it, so that as the heat rises it does not tend to destroy the effect of the repository, but rather renders it more perfect. 7th, The partial isolation or separation of the upper part of the outer case containing the heating liquid, from the lower part containing the cooling liquid, by the introduction of bad conducting material between them. 8th, The combination of the external heater with the internal heater, and the combination of the external refrigerator with the internal refrigerator, substantially as specified, for the purposes set forth."

88. For an *Improvement in Machines for Making Bed Pins;* William McBride, Bristolville, Ohio.

Claim.—"What I claim is, attaching to a common turning lathe, a sliding cutter stock, and providing such stock with two peculiarly shaped cutters, one stationary and the other movable, the stationary cutter being of such shape that it forms a tapering part of the pin, while the movable cutter is of a proper shape and construction to form a round head on the pin, and simultaneous therewith, cut off the pin from the block, ready for being discharged, substantially as described. I also claim making all the pins of a set of a uniform length, by employing a spring plug or gauge, in the manner described, and by the same means effecting their discharge after being turned, headed, and cut off."

89. For an *Improvement in Cotton Picker Cylinders;* James Pitts, Lancaster, Mass.

Claim.—"What I claim is, the constructing the screen so that the periphery of the metal intervening between any two immediately adjacent orifices shall be of a length equal to, or greater than, that of the staple of cotton, or other fibrous material to be picked, in order that the fibre shall not lap around the said periphery, and become connected, attached, or tied by its ends, as stated. I also claim constructing the cylinder screen of a hollow perforated metal cylinder, without arms or ribs, and with open hollow cylindric journals at its two ends, as stated, in order that the cotton may be drawn out of one journal by the suction draft, and any obstruction removed by a person's hand and arm introduced through the other journal, as specified."

90. For an *Improved Socket for Bench Hooks;* Joseph Sawyer, South Royalston, Mass.

Claim.—"What I claim is, the described improvement in the socket of bench hooks, the hook being secured to the socket by the same screw and nut which fasten the whole to the bench."

91. For an *Improvement in Organs;* William Sumner, Worcester, Massachusetts.

Claim.—"What I claim is, the employment of a wind chest having a main passage for the wind and branches leading therefrom, and governed by valves, substantially as specified, and connected and combined with the keys substantially as and for the purpose specified. I also claim, in combination with a wind chest operating on the plan substantially as described, the employment of auxiliary bellows, connected and combined with the main bellows and pedals."

92. For an *Improvement in Harvesters;* Solyman Bell, Marseilles, Illinois.

Claim.—"What I claim are, the pins in the sickle, or their equivalents, in combination with the scores in the guards, or their equivalents, so constructed and operated as to remove the leaves and stalks, and prevent the guards from becoming clogged, so as to obstruct the motion of the sickle."

93. For an *Improved Tool Rest for Turning Lathes;* George A. Rollins, Nashua, N. H.

Claim.—"I am aware that the tool post of a lathe has been fixed on a plate or platform that could be inclined by means of a screw; therefore I do not claim such, but I claim the improvement of combining with the tool post and tool holder, a separate rest block, in combination with making the said rest block and the post, respectively, with a convex and concave vertical bearing surfaces, the tool holder with a head or dovetail, and the tool post with a curved trapezoidal or dovetail groove, as specified, whereby the cutting tool may not only be set to any angle of inclination, but the said tool and rest, simultaneously confined in position by the downward action of the screw of the tool holder against the tool, as described."

94. For an *Improvement in Seed Planters;* John G. Snyder and Joseph Yoring, Wheatfield Township, Pennsylvania.

Claim.—"What we claim is, the sliding section in the bottom plate, in combination with the tubes and revolving perforated plate, for rendering the machine capable of hill or drill planting, at pleasure, and ensuring a regularity of deposit, as set forth. Also, the aperture in the frame, in combination with the inclined form of the plate for carrying off the surplus grains, and collecting them in the bucket, substantially as specified."

95. For an *Improvement in Bank Locks;* Linus Yale, Newport, New York.

Claim.—"I do not claim the pins, or the sliding shaft, or the covering the key chamber with the broad head; but I do claim them as arranged in connexion with the cog, which prevents their being adjusted and turned by a burglar without the proper key."

96. For an *Improved Carrier for Lathes;* Jacob Zook, Harrisburgh, Pennsylvania.

Claim.—"What I claim is, the combination of the projections on the carrier plate with the vibratory arms and eccentrics, (attached to the same pivots,) or their equivalents, situated and adjustable in and combined with the auxiliary disk and bar, arranged and operating substantially in the manner and for the purpose set forth. I also claim giving a limited elastic play, longitudinally, to the bar in the disk, by means of the slots and springs, or their equivalents, substantially as described, in order that the pressure of the eccentrics, against the article to be turned, may be equalized, in case their bearing points should, by the irregularity or eccentricity of the article, be at unequal distances from the centre of revolution, which is determined and fixed by the conical point of the driving shaft."

97. For an *Improvement in Vulcanizing India Rubber and other Gums;* L. O. P. Meyer, Newton, Connecticut.

Claim.—"What I claim is, the heating or curing of the material commonly known as the hard compound of vulcanized caoutchouc, or other vulcanizable gums, by means of the immersion of the material in or under water, or other suitable liquid, during the process of heating or curing, substantially as described."

98. For an *Improvement in Forceps Saw Sets;* James F. Brodhead, Rondout, Assignor to Thomas Ritch, Napanock, New York.

Claim.—"What I claim is, the movable bed or anvil, operating conjointly with the levers, enabling the operator to set the tooth of the saw from its point, instead of from its base, as is usual in other forceps sets, as set forth."

99. For an *Improvement in Printing Presses;* Stephen P. Ruggles, Boston, Mass.

Claim.—"What I claim is, 1st, In combination with the curved arm for carrying the inking rollers to and from the form, the spring plates with the guides at each end of the rollers, for causing said rollers to pass over the form in a plane parallel to the form, their general motion being in the arc of a circle, substantially as described. I also claim hanging the platen and the intermediate ink roller to the same rock shaft by their respective arms, so that the vibration of the platen shall throw the intermediate roller first to the grooved ink roller, and then to the ink bearer, for the purpose of receiving and distributing the ink from the ink trough at every vibration of the platen, substantially as described."

Additional Improvements.

1. For an *Improvement in Smut Machines;* Jacob Benner, Liberty, Penna.; dated Feb. 14, 1854; original patent dated Sept. 11, 1847.

Claim.—"What I claim is, making the slotted openings in the concave horizontal instead of vertical, as they are in the original patent, in the manner substantially as described. And secondly, the arrangement and combination of my machine in a close cover, together with the spouts or tubes, in the manner and for the purposes set forth."

2. For an *Improvement in Ploughs;* David Swartz, Tom's Brook, Va.; dated Feb. 28, 1854; original patent dated 22d June, 1852.

Claim.—"What I claim and desire to have added to my letters patent, of June 22d, 1852, is, attaching the comb or rake to the rear end of the mould board, by a crooked cam lever or bar and swivel, in combination with the hand lever, whereby it can be conveniently raised and lowered by rotating it upon its axis of connexion, substantially as in the manner and for the purpose set forth."

Re-Issues for February, 1854.

1. For an *Improvement in Carding, by which Variegated Slivers are produced;* Jonas Holmes and Ephraim French, Lee, Mass.; dated February 28, 1854; original patent dated May 18, 1852.

Claim.—"What we claim is, our mode of manufacturing the variegated roving or that composed of separate masses of fibrous material of different colors, laid together as described. Our said mode being a combination of processes, which consists in feeding or disposing the fibrous material upon the main card cylinder, in strands, bands, layers, or masses of different colors, and so that they shall be disposed side by side of each other, and around such cylinder, essentially as specified, and removing such fibrous material from the said main cylinder by a doffer or doffers, when constructed and made to operate therewith, substantially as specified."

2. For *Improvements in Grass and Grain Cutting Machines;* William F. Ketchum, Buffalo, New York; dated February 28, 1854; original patent dated Feb. 10, 1852.

Claim.—"What I claim is, 1st, Sustaining the outer end of the rack piece, in the manner set forth. 2d, The shield plate in combination with the shoe and cutter bar, for the purposes aforesaid."

Designs for February, 1854.

1. For a *Cooking Stove;* Samuel D. Vose, Albany, New York; dated February 14th, 1854; ante-dated December 30th, 1853.
2. For a *Cooking Stove;* Samuel D. Vose, Albany, New York; dated February 14th, 1854; ante-dated December 30th, 1853.
3. For a *Cooking Stove;* Samuel D. Vose, Albany, New York; dated February 14th, 1854; ante-dated December 30th, 1853.
4. For a *Parlor Stove;* Samuel D. Vose, Albany, New York; dated February 14th, 1854; ante-dated December 30th, 1853.

Claim to each of the above, is the combination of the several ornaments and mouldings, as arranged together.

5. For *Parlor Stove Plates;* N. S. Vedder, Assignor to A. T. Dunham & Co., Troy, New York; dated Feb. 14th, 1854.

Claim.—"What I claim is, the ornamental design and configuration."

6. For *Coal Heating Stoves;* Conrad Harris and Paul W. Zoiner, Cincinnati, Ohio; dated February 21st, 1854.

Claim.—"What we claim is, the combination and arrangement of the ornamental figures, forms, and foliage, making an ornamental design."

7. For *Guitars;* Wm. B. Tilton, New York City; dated February 21st, 1854.

Claim.—"What I claim is, the plate placed within the rosette or opening in the sound board, and slightly below the interior surface of said board, said plate hiding the interior of the instrument from view, and adding to the ornamental appearance of the guitar."

8. For *Cast Iron Legs for Piano Fortes;* Frederick Starr, Rochester, New York; dated February 28th, 1854.

Claim.—"What I claim is, the ornamental design."

9. For *Cast Iron Pedal Lyre for Piano Fortes;* Frederick Starr, Rochester, New York; dated February 28th, 1854.

Claim.—"What I claim is, the ornamental design."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

An Account of some Experiments on a Mixture of Saturated and Surcharged Steam, (Wethered's patent,) *made under the direction of* E. K. Collins, Esq. By B. F. Isherwood, Esq., Chief Eng., U. S. N.

(*With a Plate.*)

For some months past, by the public spirit and liberality of Mr. E. K. Collins, of the Collins line of Steamships, a very extensive and thorough course of experiments has been in progress, with what is known as Wethered's patent, having for their object such a treatment of steam as to greatly increase its power without any increased expenditure of fuel. The claim made in this patent by the patentees, Charles E., John, and Sam. Wethered, of Baltimore, Maryland, dated May 25, 1853, is as follows, viz:

"*What we claim as new is, the combining steam and superheated or surcharged steam, for actuating engines, when generated, the elasticity increased, and operated as set forth.*"

From this claim it will be seen that the patent does not intend the use of steam simply surcharged with heat; that is to say, having a higher temperature than is normal to the same pressure of saturated or ordinary steam; but it intends the use of *a mixture of saturated and surcharged steam.* I prefer these terms of saturated and surcharged steam to those of hydrous or anhydrous steam, or to those of steam and stame, because they are proper, and their meaning already understood; ordinary steam being saturated with water, or of maximum density for the pressure; and surcharged steam being ordinary steam surcharged with heat, having less than the maximum density for the pressure, and therefore not being saturated with water.

The idea of the patentee is, that if a certain quantity of saturated steam be withdrawn from the boiler, and heated (out of contact with water) to a high abnormal temperature, then *mixed* with a certain quantity of saturated steam, and this *mixture* used to actuate the engine, a greater power can be derived from it with a given weight of fuel than could be derived from the use of saturated steam alone, generated by the same weight of fuel.

The mode of obtaining the "mixture" for practical use is very simple, and as follows, viz: from the steam chimney or drum of the boiler, an usual steam pipe, furnished with the necessary stop valves, conveys externally to the boiler, the saturated steam to the valve chest; another similar pipe, with stop valves, &c., from the same steam chimney or drum, but starting within the smoke chimney, conveys saturated steam down the smoke chimney, through the flues and through the furnaces, passing immediately over the incandescent fuel, and then having become highly surcharged in its passage, it is led out of the front of the boiler to the same valve chest, where it is mixed with the saturated steam. From the valve chest the "mixture" passes to the cylinder of the engine, and actuates the piston in the usual manner.

In all the comparative experiments that have been made, the same engine and boiler was experimented with in both cases, being preserved in the same condition, and the results noted from the same instrument; every precaution was taken to ensure accurate *comparative* results; the same fuel was used, and the same persons employed. The experiments were open to all, and were conducted and visited by experienced engineers, wholly uninterested, pecuniarily, in the result; among the number was Mr. Daniel B. Martin, Engineer in Chief, U. S. Navy, who superintended several of the experiments in person, and by whose advice they were principally conducted. I am indebted to him for the detailed results below given.

The engine used was a common non-condensing one, the property of Mr. Collins, and kept by that public-spirited gentleman for making steam experiments. The diameter of the cylinder was $12\frac{1}{2}$ inches, the stroke of piston 12 inches, and it was worked without expansion; the cylinder was a double one, or surrounded with a steam jacket; the steam pipes were $2\frac{3}{8}$ inches inside diameter, and 8 feet long, being as direct as possible from the boiler to the cylinder. They were first covered with felt and woolen carpeting to 8 inches diameter, but the felt burning from the high temperature, it was removed, and a coating composed of a mixture of lamp black and clay, covered with felt and carpeting, was substituted. The boiler had vertical tubes, and was a working model of the boilers in the Collins line of steamships.

The work performed by the engine consisted in pumping up water into a tank, where it was kept at a constant level. Fitted to this tank was a very large air chamber containing compressed air, and the water was delivered from the pumps against the pressure of this air. The pumps were two in number, single acting, with 8 inches diameter, and 10 inches stroke of pistons; they had been made originally for air pumps to Mailfort's submarine apparatus, and they were worked from the shaft by means of eccentrics. The pump valves were of metal, with openings nearly as large as the pump barrel, and they were fitted up with the greatest accuracy. The pumps were set in the tanks with the water so disposed around and above them as to produce a head or pressure of $2\frac{1}{4}$ pounds per square inch, to overcome the friction and weight of the valves, the *vena-contracta*, &c., and to prevent there being below the pistons a less than atmospheric pressure. The air pressure in the chamber, against which the pumps delivered their water, was taken by three of Lowe's patent pressure gauges, carefully tested.

The temperatures were taken by accurate thermometers at three places; 1st, In the wrought iron steam pipe near the boiler, for the temperature of the steam; 2d, In the wrought iron pipe that carried the surcharged steam from the boiler to the valve chest; 3d, In the cast iron valve chest of the cylinder. In order to obtain these temperatures, three small cups containing mercury, and cast from the same pattern, just large enough to hold conveniently, the bulbs of the thermometers, without overflowing the mercury bath, were screwed in. The cups were about $\frac{1}{2}$-inch deep, and of course projected farther in the pipes than in the valve chest, where the metal was thicker.

With the apparatus just described, three distinct sets of experiments

were made; 1st, With saturated, or ordinary steam alone; 2d, With surcharged steam alone; 3d, With the 'mixture' of saturated and surcharged steam, in which the proportions of saturated and surcharged were about as 25 to 75.

The number of double strokes of engines' pistons made, was taken by a counter. The coal was accurately weighed, and the amount given is *inclusive* of what was required to raise steam; the coal was completely burned out, and the engine operated as long as it would work. The units of work done is obtained by multiplying the number of double strokes made by the pistons, by the pressure in the air chamber against which the pumps delivered their water.

Experiments made with Saturated Steam alone.

DATE. 1853.	Temperatures in degrees F.		Total number of double strokes of piston made during the experiment.	Pressure in air chamber (against which the pumps delivered their water) in lbs. pr sq. in. above atmo.	Pounds of anthracite coal consumed during the experiment.	Duration of the experiment in hours and minutes.	Total number of units of work done.	Units of work done with one pound of coal.	REMARKS.
	In steam pipe near boiler.	In valve chest of cylinder.							
Jun 11,	230°	217°	11143	25·25	336	6 21	281360·7	837·4	Wd westerly, weather clear.
" 24,	230	—	9732	30·46	347	6 00	296436·7	854·3	
July 6,	227	220	11940	22·25	343	6 00	265665·0	774·5	
" 7,	227	219	11620	23·75	334	6 00	275975·0	826·3	
" 29,	229	224	8682	26·50	301	6 00	230073·0	764·3	
Aug. 4,	231	226	10250	26·56	336	6 00	272240·0	810·2	Using salt water.
" 29,	228	229	5828	22·80	224	3 30	132878·4	593·2	
Totals,			69195		2221	39 51	1751628·8		
Means,	229°	$222\frac{1}{2}$°		25·36				790·0	

Experiments made with Surcharged Steam alone.

DATE. 1853.	Temperature of the surcharged steam in the pipe leading it from the boiler to the valve chest, in degrees Fahr.	Total number of double strokes of pistons made during the experiments.	Pressure in air chamber (against which the pumps delivered their water) in lbs. per sq. in. above atmos.	Pounds of anthracite coal consumed during the experim't.	Duration of the experiment in hours and minutes.	Total number of units of work done.	Units of work done with one pound of coal.	REMARKS.
Jun 25,	352°	11514	38·50	328	6 00	443289·0	1351·5	Wind westerly and weather clear.
July 2,	357	15220	28·33	348	6 00	431182·6	1239·0	
" 5,	348	14875	27·83	313	6 00	413971·2	1322·6	
Totals,		41609		989	18 00	1288442·8		
Means,	$352\frac{1}{3}$		30·97				1302·8	

Experiments with the Mixture of Saturated and Surcharged Steams.

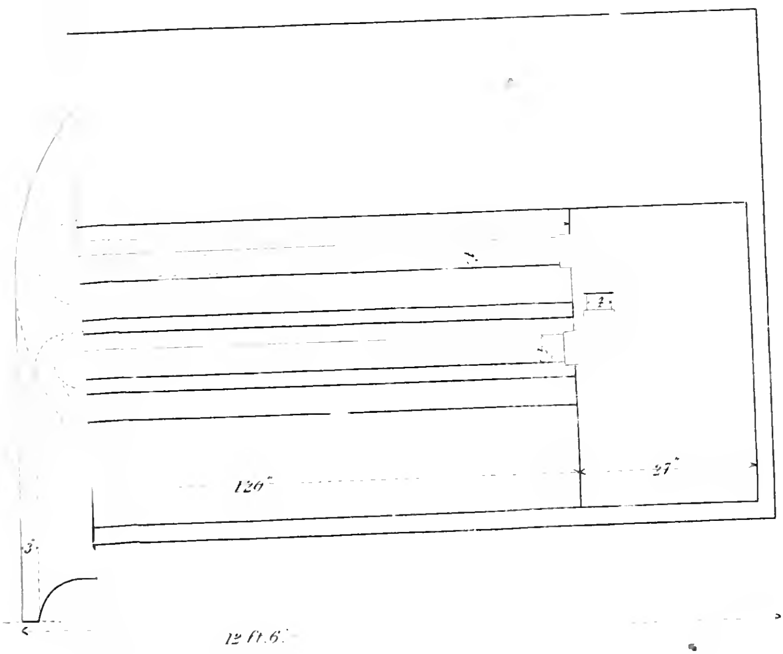
DATE. 1853.	Temperatures in degrees Fah. In steam pipe near the boiler.	Surch'd steam in pipe leading from boiler to valve chest.	Mixture in the valve chest of cylinder.	Total number of double strokes of piston made during the experiment.	Pressure in air chamber (against which the pumps delivered their water) in lbs. per sq. in. above atmos.	Pounds of anthracite coal consumed during the experim't.	Duration of the experiment in hours and minutes.	Total number of units of work done.	Units of work done with one pound of coal.	REMARKS.
J'ne 13	233°	373°	—	15499	34·70	336	6 48	537815·3	1600·6	
" 30	237	379	304°	14630	31·20	272	6 00	456456·0	1678·2	
July 1	244	380	288	14736	28·40	256	6 00	418502·4	1634·8	
" 8	233	—	289	14810	32·60	288	6 00	482806·0	1676·4	W'd easterly &
" 9	234	—	312	14676	28·20	289	6 00	413863·2	1432·1	weather clear.
" 26	241	398	300	13310	41·10	280	6 00	547041·0	1953·7	Using salt water.
" 27	—	341	311	11772	38·10	299	6 00	448513·0	1500·0	" "
" 28	238	388	290	12671	38·14	268	6 00	483271·9	1803·2	" "
" 30	242	418	294	13520	30·21	248	6 00	408439·2	1646·9	" "
Aug 30	242	414	303	7171	40·00	210	2 20	286840·0	1365·9	Br'ke pump lever
" 31	238	394	303	8213	43·70	227	3 19	358908·1	1581·1	" "
Sep. 12	240	328	303	19855	38·20	467	10 00	758461·0	1624·1	
" 13	236	360	281	21214	34·70	459	10 00	736125·8	1603·8	
Totals,				182077		3899	80 27	6337042·9		
Means,	$238\frac{1}{6}$	$379\frac{1}{3}$	$298\frac{1}{6}$		34·84				1625·3	

Summary of the Experiments with the Pumps.

		With saturated steam alone.	With surcharged steam alone.	With the mixture of saturated and surcharged steams.
Duration of the experiments, in hours and minutes,		39 51	18 00	80 27
Temp. in deg. F.	Saturated steam in the steam pipe near the boiler,	229°	—	$238\frac{1}{8}$°
	Surcharged steam in the pipe leading from boiler to valve chest,	—	$352\frac{1}{3}$°	$379\frac{1}{3}$°
	Mixture in the valve chest of the cylinder,	—	—	$298\frac{1}{6}$°
Total number of double strokes of pistons made during the experiments,		69195	41609	182077
Number of double strokes of pistons made per minute,		29·84	38·53	37·72
Pressure in air chamber (against which the pumps delivered their water) in pounds per square inch above atmosphere,		25·36	30·97	34·84
Total amount in pounds of anthracite coal consumed during the experiments,		2221	989	3899
Amount of anthracite, in pounds, consumed per hour,		55·7	55·0	48·5
Total number of units of work done,		1754628·8	1288442·8	6337042·9
Units of work done with one pound of coal,		790·0	1302·8	1625·3
Units of work done with one pound of coal reduced to proportionals,		1·0000	1·6191	2·0573

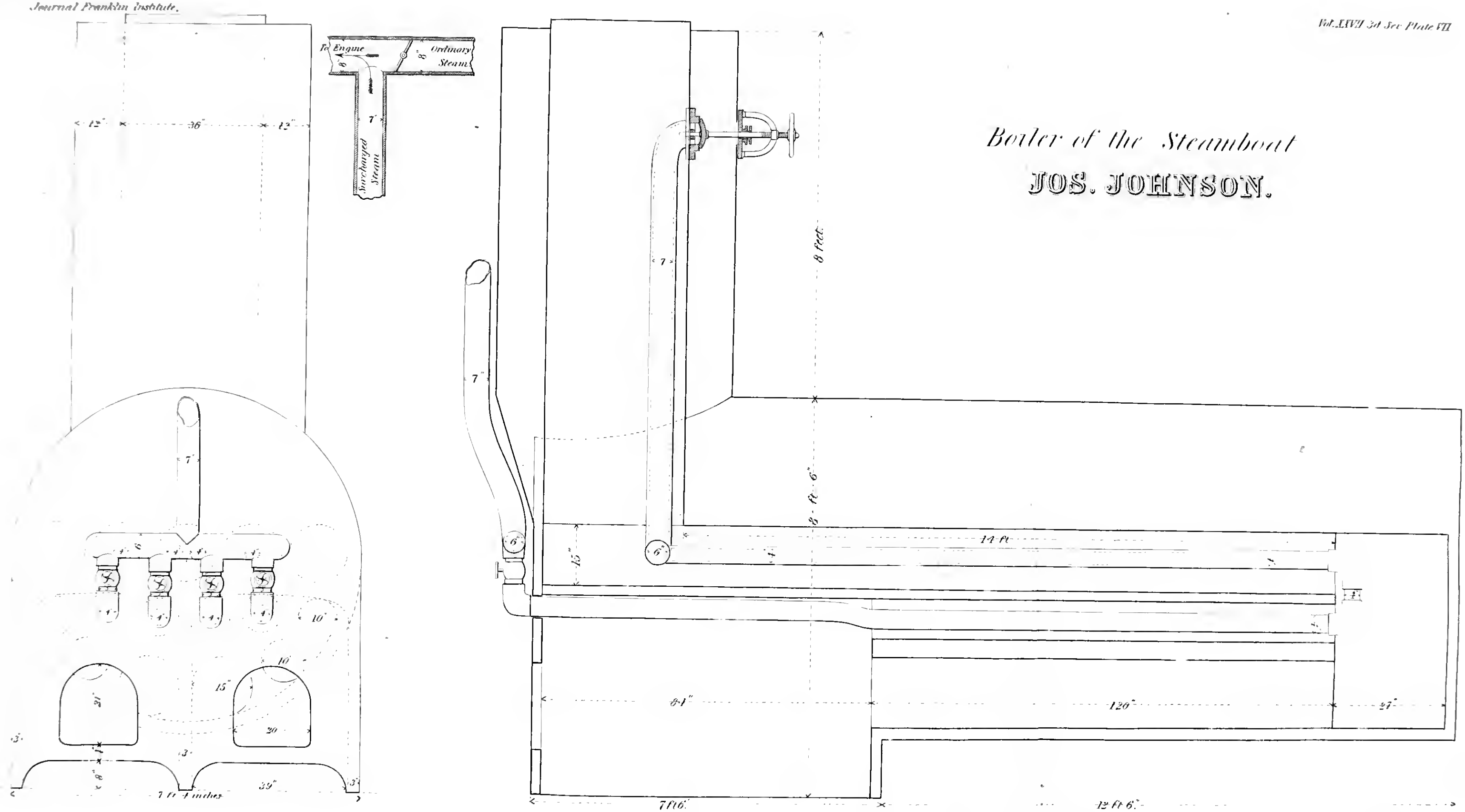
iler of the Steamboat

JOS. JOHNSON.



Boiler of the Steamboat

JOS. JOHNSON.



From this summary, it will be seen that, using the steam simply surcharged, produced, with the same fuel, an increased effect of 65 per centum over what was obtained with the saturated or ordinary steam alone; while an increased effect of 106 per centum was produced by the use of the "mixture." Also, the increased effect of the "mixture" was 25 per centum over what was obtained from the surcharged steam alone.

Experiments with Saturated Steam alone, and with a Mixture of Saturated and Surcharged Steam, on board the Steamboat Joseph Johnson.— After the experiments just described, made with the small stationary engine and pumps, it was considered still necessary to verify their results by operating with a steamboat under the ordinary condition of practice. For this purpose the *Joseph Johnson*, a tug steamboat, was obtained, and the experiments hereafter detailed were made with her on the Hudson River, at New York. These experiments were strictly comparative—the same instruments in the same positions—the same fuel, persons, &c., being employed, and every precaution was taken to secure accuracy. The weather, tide, &c., was also selected as nearly alike as possible.

The *Joseph Johnson* had one engine, with the cylinder $31\frac{1}{2}$ inches diameter and $6\frac{3}{4}$ feet stroke of piston. The steam was cut off in the supply pipe by a fly-valve and cam-board at $\frac{5}{8}$ths the stroke of piston from the commencement. (Plate VII.)

There was one iron boiler, with the furnace and direct flues below and single return ascending flues above. A steam chimney surrounded the smoke chimney, and the average temperature of the latter was 600° Fah.

The steam for the "mixture" was surcharged by taking it from the steam chimney inside the smoke chimney, leading it down the latter, then through the upper flues, then returning through the lower direct flues, and through the furnace over the incandescent fuel to the front of the boiler, whence it was led to the supply pipe, and there mixed with saturated steam, brought by a pipe externally to the boiler from the same steam chimney.

The following tables, furnished by Mr. Martin, who witnessed the experiments, contain, in detail, all the observed facts:—

Experiment with Saturated Steam alone, Jan. 9th, 1854. Air calm. Water smooth.

TIME. HS. MIN.	Steam pressure in boiler in lbs. per sq. in. above atmosphere.	Vacuum in condenser per gauge in inches of mercury.	Mean temperature of the metal of the cylinder in degrees Fahr.	Temperature of the exhaust steam in degrees Fahrenheit.	Number of double strokes of piston made.	Number of double strokes of engine piston made per min.
A. M.						
9 35	20	(Started engine, having used 1200 lbs. of coal in raising steam.)				
9 45	19	26½	223°	133°	Not noted.	
10 00	21	27¾	222	121	278	18·53
10 15	22½	"	222	121	294	19·60
10 30	22	"	218	120	296	19·73
10 45	22	"	220	122	298	19·86
11 00	21½	"	218	125	304	20·26
11 15	18½	27½	216	125	289	19·26
11 30	16	"	212	125	282	18·80
11 45	18	"	215	127	295	19·66
12 00	20	"	220	125	308	20·53
12 15	18½	"	214	119	293	19·53
12 30	15½	"	208	119	267	17·80
12 45	18	"	214	125	Stop'd 8 mn.	Not noted.
1 00	18	"	218	129	291	19·40
1 15	19½	"	226	125	299	19·93
1 30	21½	"	228	125	288	19·20
1 45	22½	"	222	125	297	19·80
2 00	16	28	208	121	288	19·20
2 15	12	28	216	115	266	17·73
Stopped 39 minutes.						
3 00	19	28	240	160	111	18·50
3 15	18	27½	240	125	273	18·20
3 30	18	27	238	128	276	18·40
3 45	18½	27½	241	127	285	19·00
4 00	18½	27½	240	123	290	19·33
4 15	20	27	244	127	299	19·93
4 30	21	27½	246	128	296	19·73
4 45	21	"	244	127	299	19·93
5 00	20½	"	242	125	310	20·66
5 15	20	"	240	123	288	19·20
5 30	22	"	244	125	272	18·13
5 45	21½	"	244	125	284	19·00
6 00	20	"	242	125	300	20·00
6 15	21	"	242	125	303	20·20
6 30	20	27¾	240	125	292	19·46
6 45	20	27¾	244	125	290	19·33
7 00	20	28	244	125	299	19·93
7 15	20	27½	244	125	292	19·46
7 30	20	"	244	125	296	19·73
7 45	19	"	242	125	289	19·23
8 00	19	"	242	125	297	19·80
8 15	18	"	240	125	284	18·93
Totals, 9 53					11447	19·303
Means,	19·5	27·5	231·1	125		

Experiment with a Mixture of Saturated and Surcharged Steam, January 5th, 1854. *Air Calm. Water perfectly Smooth.*

TIME. HS. MIN.	Steam pressure in boiler in lbs. per sq inch above atmosphere	Vacuum in condenser per gauge in inches of mercury.	Mean temperature of the metal of the cylinder in deg. Fahr.	Temperature of the surcharged steam before its mixture with sat'd steam, in deg. F.	Temperature of the mixture of saturated and surcharged steam in deg. Fahr.	Temperature of exhaust mixture in degrees Fahr.	Number of double strokes of engine piston made.	Number of double strokes of engine piston made per minute.
A. M.								
7 40	16	(Started engine, having used 1200 lbs. of coal in raising steam.)						
8 00	22	27½	236°	435°	308°	137°		
8 15	21½	28	248	455	315	139	306	20·40
8 30	21½	28	246	468	320	137	296	19·73
8 45	21½	27½	256	475	324	139	317	21·13
9 00	21½	"	265	500	332	143	319	21·26
9 15	20	"	275	500	346	150	317	21·13
9 30	20	28	277	530	336	148	300	20·00
9 45	20½	28	283	515	334	143	318	21·20
10 00	21	27½	283	525	340	145	330	22·00
10 15	20	28	286	540	350	147	309	20·60
10 30	20	28	294	560	358	145	310	20·66
10 45	21	28	294	580	358	145	323	21·53
11 00	21	28	299	600	364	149	318	21·20
11 15	16	28	Stopped 2 minutes.		Data not noted.		Not	
11 30	15	27¾	280	490	322	153	noted	—
11 45	15	27½	290	505	330	145	"	—
12 00	16	"	290	530	348	150	"	—
12 15	18	"	294	572	366	152	"	—
12 30	17	"	292	560	356	145	"	—
12 45	15	28	297	615	360	150	"	—
1 00	13	28	304	670	370	155	"	—
Stopped 45 minutes.								
2 00	12	28½	254	488	310	137	281	18·73
2 15	15	28¼	262	500	325	135	272	18·13
2 30	18	28	280	535	344	154	291	19·40
2 45	18½	27½	290	545	360	160	309	20·60
3 00	19	"	298	582	370	140	319	21·33
3 15	20	"	304	605	378	155	323	21·53
3 30	19½	"	308	615	378	155	310	20·66
3 45	20	"	314	685	382	155	314	20·93
4 00	19½	"	314	680	370	153	312	20·80
4 15	19	"	312	685	375	145	304	20·26
4 30	19	28	313	680	370	155	312	20·80
4 45	19	27¾	308	670	360	150	314	20·93
5 00	19	28	302	690	360	145	312	20·80
5 15	19	28	303	720	376	140	307	20·50
5 30	18½	28	308	720	356	155	307	20·50
5 45	18	28	310	720	360	155	320	21·33
6 00	17	28¼	300	550	350	150	310	20·66
6 17	13	28½	294	550	340	145	Not noted.	
Totals, 9 50							11904	
Means,	18·5	27·8	289·2	577·1	350·7	147·6		20·176

Summary of the Results obtained from the Experiments made Jan. 5th and 9th, 1854.

	Saturated steam alone.	Mixture of saturated and surcharged steam.
Duration of the experiment in hours and minutes, . .	9 53	9 50
Steam pressure in boiler in lbs. per sq. in. above atmosphere,	19·5	18·5
Vacuum in condenser per gauge, in inches of mercury, .	27·5	27·8
Mean temperature of the metal of the cylinder, in degrees F.,	231·1	289·2
Temperature of the exhaust, in degrees Fahrenheit, .	125·0	147·6
Temperature of the surcharged steam before its mixture with the saturated steam, in degrees Fahrenheit, .	—	577·1
Temperature of the mixture of surcharged and saturated steams, in degrees Fahrenheit, ...	—	350·7
Total number of double strokes of piston made during the experiments, ...	11447	11904
Number of double strokes of piston made per minute, .	19·303	20·176
Pounds of anthracite coal consumed per hour, . .	666·664	440·824

Relative Economical Efficiency of the two modes of using Steam, as applied to the Steamboat Joseph Johnson, January 5th and 9th, 1854.—As the conditions under which the two experiments were made were sensibly the same, the cubes of the number of double strokes of engine piston, made per minute, will be taken for the expression of the useful effect obtained, and the consumption of coal per hour will be taken for the expression of the cost. Hence we have the following, viz:—

Double strokes of engine piston per minute.	Useful effect.	Lbs. of coal consumed per hour.	Cost.	Relative economical efficiency.

Saturated Steam alone.

$$19{\cdot}303 = 1{\cdot}00000 \text{ and } 1{\cdot}00000^3 = 1{\cdot}00000.\quad 666{\cdot}664 \text{ or } 1{\cdot}00000 \text{ and } \frac{1{\cdot}00000}{1{\cdot}00000} = 1{\cdot}00000$$

Mixture of Saturated and Surcharged Steam.

$$20{\cdot}176 = 1{\cdot}04523 \text{ and } 1{\cdot}04523^3 = 1{\cdot}14192.\quad 440{\cdot}824 \text{ or } 0{\cdot}66124 \text{ and } \frac{1{\cdot}14192}{0{\cdot}66124} = 1{\cdot}72694$$

Whence appears that the economical efficiency of the "mixture" is 72·694 per centum greater than that of the saturated steam alone.

The piston pressure in the two cases will be in the ratio of the squares of the number of double strokes of piston made per minute, or as 1·0000 to 1·0925; and the powers exerted by the engine will compare as the product of the piston pressures multiplied by the number of double strokes of piston made per minute, or as 1·00000 to 1·14192, or as the cubes of the number of double strokes of piston made per minute.

Experiment with Saturated Steam alone, Nov. 22, 1853. Air Calm. Water Smooth.

TIME. HS. MIN.	Steam pressure in boiler in pounds per square inch above atmosphere.	Temperature in the steam pipe near the boiler, in degrees Fahrenheit.	Temperature of the steam in the valve chest of the cylinder, in degrees Fahrenheit,	Temperature of the exhaust steam, in degrees Fahr.	Number of double strokes of piston made by counter.	Number of double strokes of engine piston made per minute.	Total pounds of anthracite coal consumed.	Pounds of anthracite burned per hour.
10 21	24	240°	178°	130°				
10 51	23½	248	180	139	590	19·67		
11 21	25½	254	185	139	635	21·17		
11 51	18	240	174	130	578	19·27		
12 21	24	249	195	135	620	20·67		
12 53	21	250	209	135	589	18·41		
1 23	27	257	210	134	618	20·60		
1 53	24	252	210	132	688	22·93		
2 23	18	245	200	128	605	20·17		
2 53	20	245	205	130	613	20·43	2055	453·3
Totals, 4 32					5536		2055	
Means,	22·55	249·7°	195°	133·6°		20·352		453·3

Experiment with a Mixture of Saturated and Surcharged Steam, November 23, 1853. Air Calm. Water Smooth.

TIME. HS. MIN.	Steam pressure in boiler in pounds per square inch above atmosphere.	Temp. of surcharged steam in pipe conducting it from boiler to valve chest, (before mixing,) in degrees Fahrenheit.	Temperature of the mixture in the cylinder valve chest, in degrees Fahrenheit.	Temperature of the exhaust of the mixture in degrees Fahrenheit.	Number of double strokes of engine piston made by counter.	Number of double strokes of engine piston made per minute.	Total pounds of anthracite coal consumed.	Pounds of anthracite burned per hour.
12 08	21							
12 38	23½	484°	342°	From 130° to 140°.	596	19·87		
1 08	20	552	348		625	20·83		
1 38	18	566	342		611	20·37		
2 08	18	600	330		592	19·73		
2 38	16	564	326		590	19·67		
3 08	18	600	326		616	20·53		
3 38	18	592	322		617	20·57		
4 08	20	600	331		590	19·67		
4 38	17	620	342		618	20·60	1300	288·9
Totals, 4 30					5455		1300	
Means,	18·94	578·3°	333·4°	135°		20·204		288·9

Summary of the Results obtained from the Experiments made Nov. 22 and 23, 1853.

	Saturated steam alone.	Mixture of saturated and surcharged steam.
Duration of the experiment in hours and minutes, . .	4 32	4 30
Steam pressure in the boiler in pounds per square inch above atmosphere, ...	22·55	18·94
Temperature of steam in the steam pipe near boilers, in degrees Fahrenheit, ...	247·7°	—
Temperature of steam in valve chest of the cylinder, in degrees Fahrenheit, ...	195°	—
Temperature of surcharged steam in the pipe conducting it from the boiler to the valve chest, (before mixing,) in degrees Fahrenheit, ...	—	578·3°
Temperature of the mixture in the cylinder valve chest, in degrees Fahrenheit, ...	—	333·4°
Temperature of the exhaust, ...	133·6°	135°
Number of double strokes of engine piston, made by counter,	5536	5455
Number of double strokes of engine piston, made per minute,	20·352	20·204
Total pounds of anthracite coal consumed, . .	2055	1300
Pounds of coal consumed per hour, . . .	453·3	288·9

Relative Economical Efficiency of the two modes of using Steam, as applied to the Steamboat Joseph Johnson, November 22d and 23d, 1853.—As the conditions under which the two experiments were made were sensibly the same, the cubes of the number of double strokes of engine piston, made per minute, will be taken for the expression of the useful effect obtained, and the consumption of the coal per hour will be taken for the expression of the cost. Hence we have the following, viz:—

Double strokes of engine piston per minute.	Useful effects.	Lbs. of coal consumed per hour.	Cost.	Relative economical efficiency.

Saturated Steam alone.

$$20{\cdot}352 \text{ or } 1{\cdot}00732 \text{ and } 1{\cdot}00732^3 = 1{\cdot}02212. \quad 453{\cdot}3 \text{ or } 1{\cdot}56916 \text{ and } \frac{1{\cdot}02212}{1{\cdot}56906} = 0{\cdot}65142.$$

Mixture of Saturated and Surcharged Steam.

$$20{\cdot}204 \text{ or } 1{\cdot}00000 \text{ and } 1{\cdot}00000^3 = 1{\cdot}00000. \quad 288{\cdot}9 \text{ or } 1{\cdot}00000 \text{ and } \frac{1{\cdot}00000}{1{\cdot}00000} = 1{\cdot}00000.$$

Whence appears that the economical efficiency of the "mixture" is $\left(\frac{1{\cdot}00000}{0{\cdot}65142} - 1. = \right)$ 53·51 per centum greater than that of the saturated steam alone.

The object in the above trial was to make the same number of revolutions of the wheels in equal times, so as to give the boat the same speed. The same distance was run (from Canal street wharf, New York, City, to Cold Spring, 56 miles,) with the "mixture" and with the steam

alone; and to keep the speed about the same, the time was noted at corresponding points along the river, so that the difference should tell in the fuel only. But with the "mixture," in order to keep the pressure sufficiently down, to obtain the same speed as with the steam alone, it was necessary to carry the fires ruinously low, so that at times portions of the grate bars would be entirely bare. It is to this fact that the lower result, comparatively, obtained from the "mixture" in the above trial is to be attributed.

From the experiments thus far made, no difficulty has been experienced from the burning out of the pipes conveying the surcharged steam. The data as given may be relied on as truthful, and the reader can account for the results in any way he chooses—of the practical facts there exists no doubt. I have given all the experiments that have been furnished me, and they include, I believe, all, or about all, that have been made.

For the Journal of the Franklin Institute.

Note on Dr. Wetherill's Remarks upon a Process for Organic Analysis. By J. H. Alexander and Campbell Morfit.

All contributions which tend to make us acquainted with the resources of science or to extend its domain, are ever welcome; but all personal questions of individual laudation or criticism, unless connected with some point of scientific ethics, are generally unhappy, and always unimportant to the public.

If we understand Dr. Wetherill's remarks rightly, they are intended for the establishment of two points relating to the apparatus which we had occasion to describe in the February Number of the Journal, viz: 1st, That said apparatus is not new; 2d, That it is not an improvement, as we had supposed.

The first point is without interest to us, inasmuch as we have not raised it. Habitually careful of the possible rights of others as of our own, we forebore to claim an invention or to allege novelty. In our view, any process is to be appreciated in proportion to its convenience and utility. The fact of its not having been thought of or practised before, is of value solely to the individual concerned; and to him, in proportion to his aspirations after cotemporary celebrity or posthumous historical eminence. The last motives could not, at least they certainly did not, operate with us in devising or giving account of the process in question.

And the second point raised is nearly as indifferent to us as the former; since, after all the interesting references furnished by Dr. Wetherill, which show that the divers foreign processes and our own are not the same, the solution of the question of improvement must necessarily remain for some time a matter of mere opinion.

If any practical chemist is disposed to consider that the use of oxide of copper is always necessary, and that the cut-off at the reservoir instead of the combustion tube is the most convenient and fecund, and

that the elaborate and rather cumbrous fixtures for a gas furnace instead of the alcohol flame, are the most advantageous, and that the employment of a gauged reservoir tends to increase the doubts, we are quite content, with the most perfect respect, to leave such an one in quiet enjoyment of his ideas. We do not apprehend that they will be ultimately sustained by experience or entertained by the Profession.

Baltimore, 10th March, 1854.

For the Journal of the Franklin Institute.

Magnetic-Iron Beds of the Penokie Range, on the South Shore of Lake Superior, in the State of Wisconsin. Condensed from Dr. Owen's Geological Survey of Wisconsin, &c. By Dr. L. Turnbull.

(Continued from page 186.)

The most Easterly appearance of magnetic iron ore, which was observed by Colonel Whittlesey, was in fissile black slate, about four miles West of the Montreal Trail, in Section No. 4, W. The bed lies back of the trappose range, about sixteen miles from the Lake, in a protrusion of metamorphic slates. About four miles along the strike of the beds, South-west by West, the bed was seen by W. Randall, in 1848, in the Fourth Principal Meridian, in Township 44° North, eighteen miles from the lake. From thence he and his assistant traced it, at moderate intervals, along the uplift, to the West end of "Lac des Anglais," or about fifteen miles, to where the range terminates. Here the metamorphic slates are replaced by syenitic rocks.

There is a continuous bed of iron ore from the meridian westward to Lac des Anglais. Its thickness, richness, and value vary very much.

The geological relations of the iron-bearing strata are exhibited in the two following sections; the first taken near the trail that passes over the Pewabic Range, between the forks of the Tyler branch of Bad River; the second, South of Lac des Anglais.

d d, Drift.
c, Slaty Magnetic Iron, fifty feet.
b, Compact and Slaty Quartz.
a, Talcose Slate.

d d, Drift.
c, Iron bed, twenty-five to sixty feet.
b, Quartz, thirty feet.
a, Hornblende and Slaty Quartz.

On the Pewabic Range the strike of the beds is East by North; the dip North by West, 80° to 85. The beds of quartz are of great thickness—two hundred to two hundred and fifty feet. Near the junction of

the quartz and talcose slate the latter assumes the aspect of novaculite. The iron-bed is schistose in its structure, and is composed of magnetic oxide, sometimes alternating with beds of quartz.

The bed of magnetic iron ore, South of Lac des Anglais, is of extraordinary thickness—twenty-five to sixty feet. The proportion of iron and quartz is very variable, but the separation of them by mechanical means would, in general, not be difficult. The bands of ore vary from mere thin laminæ to a thickness of twelve and even eighteen inches, presenting, sometimes, a black surface, contrasting with the white and gray color of the quartz, and sometimes a bright metallic gray color.

There are many places in the mountain, West of Bad River, which present more than fifty feet of quartz and iron, in about equal proportions.

Where the West Branch of Tyler's Fork crosses this chain, W. Beesly found the Southerly face of the uplifts well charged with a rich, heavy ore, showing thirty-five and seventy feet, with iron predominating over quartz.

All the specimens were of the black magnetic oxide, without any of the red.

The productive yield of such an ore can only be determined by trial, in properly constructed furnaces; but, judging of the specimens by weight, they will afford fifty to sixty per cent. of metal. The following is an analysis of one specimen, by Dr. Owen, which yielded the following results:—

Analysis of Specimen No. 7, from the Slaty Beds of the Mountain South of Lac des Anglais.

Peroxide of Iron,	51·5
Protoxide of Iron,	27·1
Mixed Oxides of Iron,	78·6=56·3=Iron.
Silica,	20·8
Magnesia,	00·6
Alkali,	00·2
Fluoric Acid,	a trace.
	100·2

The excess arises from an absorption of oxygen by the protoxide. The analysis is subject to revision, if time permits, in this particular; but the result in pure iron cannot be materially changed. This specimen is apparently 10 or 20 per cent. below the richest pieces brought from the range, and is above some of the poorer slaty specimens.

For present use, a supply of ore may be obtained from the rubbish at the foot of the uplifts, in blocks and pieces already detached from the cliff and the accompanying quartz. Where it is not dislodged, it will be necessary to break the whole, and then assort it. There are cases where numerous particles of the oxide is disseminated through the quartz rock, above and below the regular beds. This might be separated by bruising and stamping—a process which the whole must undergo, in order to be profitably wrought in the forges.

There is no limestone yet known in the region to be used as a flux; but there is an abundance of timber and water-power.

There are certain proportions of iron and silex, and of silex and magnesia, that are easily fused. If the silex of this ore is not so excessive as to make it refractory, or if, in practice, that difficulty can be remedied by the use of magnesian slates, which are abundant, these mines may be wrought hereafter at a profit, and rival the works of Northern Europe.

The magnetic ores of the Northern part of the State of New York, that have produced iron famous for its strength, are also siliceous. The magnetic iron ore is freed of a portion of its silex, at little expense, after being bruised, by the application of magnets, acting on a large scale upon the magnetic particles. The part which enters chemically into the ore, forming a silicate, is not wholly cleared by working, but gives a very fine-grained metal that is peculiarly good for steel.

The famous Swedish iron is from beds of magnetic ore, embraced in hornblende rocks, doubtless metamorphic, and analogous to the Bad River rocks. The extensive mines or rather mountains of iron ore in Michigan, described by Houghton, Burt, Jackson, Foster, and Whitney, are also magnetic, and associated with metamorphic slates. These ores are, in some cases, more inclined to the peroxide than the Bad River beds; but specimens from the two regions are often so similar that no one would be able to separate them by the texture, color, or weight. The geological associations are precisely alike. In Michigan, as in Wisconsin, the mountains composed of tilted magnesian, hornblende, and siliceous slates, enclose beds of ore.

There, as here, on each side of the metamorphic range, are igneous rocks, of various ages and composition—quartzose, granetic, syenitic, and trappous. The ores of that region have attracted attention, and one establishment for making blooms direct from the ore has been in operation more than a year—(1852.) The iron is remarkable for its solidity and toughness, keeping its place better than Swedish, and no more brittle. It possesses the quality of being worked into fine cold-drawn wire, and has been sought after by an establishment for manufacturing wire in Massachusetts.

The blooms brought from Lake Superior to the Pittsburgh market are, however, represented as being inclined to "red short," that is, liable to crack under the roller or hammer, at about a red heat.

The position of the best exposures of ore which Colonel Whittlesey saw, was such as to require from eighteen to twenty-eight miles of transportation to reach the lake. The nearest natural harbor is in Chegworegin Bay, about twenty-five miles from the central part of the Kenokie Range. At Montreal River, which is the nearest part of the coast, and from its mouth to the mouth of Bad River, there is no place where an artificial harbor can be made. At Bad River there will be a good harbor, when the sand-bar at the mouth is removed, and kept clear by the construction of piers.

(To be continued.)

Translated for the Journal of the Franklin Institute.

Specific and Latent Effects of Vapors. By MM. Favre and Silbermann. (*Ann. de Chem. et de Phys.*, April, 1853, p. 461.)

MM. Favre and Silbermann have, by means of their Mercurial Calorimeter, found the following values:—

Name of the Substance.	Specific Heat.	Latent Heat.
Bicarburet of Hydrogen, (from Amylic Alcohol. Boiling point, 200°–210° Cent.,)	0·489	59·91
Bicarburet of Hydrogen, (from Amylic Alcohol. Boiling point, 240°–260° Cent.,)	0·496	59·71
Wood Spirit,	0·671	263·86
Wine Alcohol,	0·644	208·92
Amylic Alcohol,	0·587	121·37
Sulphuric Ether,	0·503	91·11
Acetic Ether,	0·483	105·80
Essence of Turpentine,	0·467	68·73
Sulphurous Acid,		94·56

Archives des Sciences Phys. et Nat. vol. xxiii, p. 385.

Translated for the Journal of the Franklin Institute.

Condensation of the Gases by Porous Bodies. By MM. Favre and Silbermann. (*Ann. de Chem. et de Phys.*, April, 1853, p. 471.)

M. Mitscherlich sought to determine, by calculation, the state in which carbonic acid must exist in the pores of the charcoal, after the absorption of the gas; and he arrived at the conclusion, that at least one-third of the condensed carbonic acid must be in a liquid state on the surface of the cells, and that this liquid layer was not thicker than 54 thousandths of a millimetre, distributed over the whole absorbing surface. The layer would be thicker for other gases more easily absorbable and liquifiable.

It was interesting to know the heat disengaged by this condensation; we might hope to obtain some data or some suitable hints upon the numbers which express the latent heat of liquifaction of some gases which it would be difficult to determine directly.

MM. Favre and Silbermann have found that one gramme of gas, condensed by charcoal, disengages

$$\left.\begin{array}{ll}\text{Chlorhydric Acid,} & 232{\cdot}5\\ \text{Sulphurous Acid,} & 139{\cdot}9\\ \text{Carbonic Acid,} & 129{\cdot}6\end{array}\right\}\text{ Units of heat.}$$

One gramme of Charcoal absorbs, of Chlorhydric Acid, 69·2 cubic centimetres.
" " Sulphurous Acid, 83·2 "
" " Carbonic Acid, 45·2 "

On comparing the heat disengaged by the condensation of sulphurous acid with its heat of vaporization, we find that the first surpasses the second by 45·34 units.

This difference is so great that it may include the latent heat of solidification of the sulphurous acid, so that it is not impossible that the gas may be fixed in the same state as the coloring matters or certain salts which carbon has the property of removing from water.

If we admit that the liquid sulphurous acid wets the pores of the

charcoal, the experiment leads us to allow a part of the heat disengaged as due to the affinity of the charcoal for the liquified product.

These experiments show no ratio between the power of condensation of charcoal and the solubility of the gases in water.—*Archives des Sciences Phys. et Nat.* vol. xxiii, p. 386.

For the Journal of the Franklin Institute.

Particulars of the Steamer Quaker City.

Philadelphia.—Hull built by Vaughan & Lynn. Machinery by Merrick & Sons. Owners, American Steamship Company. Intended service, Philadelphia and Charleston.

HULL.—		
Length for tonnage,		230 feet.
Length on deck,		240 " 3 inches.
" deep load water line,		225 " 4 "
Breadth of beam at midship section,		36 "
Depth of hold,		21 " 3 "
Length of engine space,		76 " 4 "
Shaft, forward of stern post, at deep load line,		91 "
Draft of water at deep load line,		12 "
Tonnage, custom house,	1421	
Area of immersed section at load draft,		390 sq. feet
Contents of bunkers in tons of coal,	180	
Masts and rig—Foretopsail schooner.		
ENGINE—One—Side lever.		
Diameter of cylinder,		85 inches.
Length of stroke,		8 feet.
Maximum pressure of steam in pounds,	28	
Cut off variable from $\frac{1}{3}$ to $\frac{2}{3}$ stroke.		
Maximum revolutions per minute,	20	
BOILERS—Four, return tubular, 2 forward, 2 aft of engine.		
Length of boilers,		14 feet.
Breadth "		10 " 4 inches.
Height " exclusive of steam drum,		11 " 1 "
Number of furnaces in all boilers,	16	
Breadth of furnaces,		2 "
Length of grate bars,		7 " 3 "
Number of tubes in all boilers,	800	
Internal diameter of tubes,		3 "
Length of tubes,		9 "
Heating surface,		7820 sq. feet.
Diameter of smoke pipes (two),		5 feet 3 inches.
Height "		35 "
Description of coal,	Anthracite.	
Draft,	Natural.	
Consumption of coal per hour, (expected,)	3000 pounds.	
PADDLE WHEELS.—Ordinary radial.		
Diameter over blades,		30 feet 4 inches.
Length of blades,		10 "
Depth "		20 inches.
Dip of wheels at load line,		5 " 3 "
Average revols. per min., (expected) at above pressure, and draft of water,	17	

Remarks.—Braced with diagonal double laid iron straps, $4\frac{1}{2} \times \frac{5}{8}$. Floor filled in solid. Frames moulded 16 inches, sided 15. Apart 30 inches, increasing at ends to 31, 32, and 33 inches. Has Pirsson's surface condenser, with 2430 square feet of tube surface.

For the Journal of the Franklin Institute.

Results obtained from Testing the Strength of an Iron Girder, recently constructed at the Architectural Iron Works of J. A. Gendell & Co., *Philadelphia.* By B. Severson.

The girder, 34 feet $6\frac{1}{2}$ inches long, $2\frac{1}{2}$ feet deep at the middle of its length, and weighs 3450 pounds. It is designed for a floor girder for a store, where it may be required to bear a uniform load of 20 tons. It was placed on piers or bearings 33 feet apart, making a clear span of 33 feet. A platform of this length was then suspended under the girder, by means of nine suspenders passing over its upper chord or flanch, and placed about four feet apart. The platform was then uniformly loaded with pig iron, accurately weighed. This load was made 32 tons on the first day. The next day, during the forenoon, it was raised to 42 tons, and in the afternoon of this same day to 52 tons. At this stage of the trial one of the piers yielded sideways, causing the girder to twist so as to produce a lateral deflexion of about six inches, and must have broken had the load not come down on to some blocks placed on the ground in anticipation of such a result.

As this put a stop to further trial, the load was now removed, and to the utter astonishment of all, the girder resumed its original form, with the exception of a slight lateral bend, in consequence of the unnatural lateral strain produced by the yielding of the foundation. But in the vertical direction—the only way it could have been strained when properly fixed in a floor—it has quite come up to a straight line on its under side, just as it was originally formed; thus showing that the material has not been strained beyond its elastic limit, and therefore its strength is not impaired in this direction. If, then, as writers on the strength of iron state, the elastic limits are equal to only about one-third of its ultimate strength, this girder would, in a proper position, have borne over 150 tons. This may be too high a figure; still, from the data furnished, it is believed that it would bear from 90 to 100 tons. This opinion is not only based upon the above facts, but the general appearance of the effect of this load on the girder was closely observed, with a view to decide beforehand the limits of its strength, and also to decide at what point it would be most likely to fail. The opinion seemed to be general among those who witnessed the trial, that, under fair circumstances, it would bear a load of from 90 to 100 tons. The amount of deflexion, as well as its form, was also carefully noted for the same purpose; but this was so regular and uniform throughout, that no indication of anything but uniform strength could be gathered from this. Nor could any other clue be discovered from which even an opinion could be formed whether the girder was weakest at the middle, the ends, or at intermediate points.

Taking into consideration the weight, length, and depth of this girder, and the result of this test is believed to be superior in value to any other ever published. For the purpose of comparing results with others, I have selected one of the malleable tubular girders, and, I believe, one of the best of Fairbairn's experiments, made prior to the construction of the Britannia Bridge. The one I refer to was 31 feet 6 inches long,

clear span 30 feet, and weighed 44 cwt. and 3 qrs. Last observed deflexion, 3·03 inches, and breaking weight $57\frac{1}{2}$ tons. The deflexion of mine, under a load of 51 tons, (last measurement,) was $1\frac{5}{16}$ inch, and, under a load of $57\frac{1}{2}$ tons, it would not, at this rate, have exceeded $1\frac{1}{2}$ inch, or about one-half the deflexion of the tubular girder under the same amount of load. And, notwithstanding mine is *longest by three feet*, and weighs about *one-third less* than the other, yet mine was not injured by the strain of a load of 52 tons, while the other broke down under a load of $57\frac{1}{2}$ tons. Or, the tubular girder failed under about $25\frac{2}{3}$ times its own weight, while mine, with the disadvantage of 3 feet greater length—(this is a disadvantage when compared in this way)—stood under $30\frac{2}{3}$ times its own weight, without sustaining *any injury*. And, so far as the amount of deflexion indicates the measure of strain, it would seem that mine might stand under sixty times its own weight, or would bear over 100 tons. And, in order to determine fully as to all the merits, and strike the balance between the two girders, it becomes necessary to take into consideration the probable cost of labor and materials used in each. In mine is used one piece of cast iron, weighing 2820 pounds, and two malleable ties, weighing 630 pounds, in all=3450 pounds; while the tubular girder is presumed to have been made wholly of malleable iron, which is much more expensive than cast iron. Therefore, taking into consideration the difference between the first cost of 2820 pounds of cast iron in mine, and an equal amount of malleable iron in the other, (leaving the 630 pounds in my ties against an equal amount in the other,) and add the difference to the entire cost of the one-third greater weight of the tubular girder, together with the greater cost of labor in making the tube, and the difference will be one-third or one-half in favor of mine; and yet, as before shown, mine possesses nearly if not quite double the value of the other in strength.

I do not feel disposed to underrate the skill and scientific attainments of others, but the question of *girders* is an important one, and if I have succeeded in devising one of superior merit, its importance will be readily appreciated. If there are any errors in the form or construction of this girder, I wish them to be pointed out. It *can* be seen now, just as it came out of the trial. I wish some of the members of the Institute would come and make an examination.

Philadelphia, March 10, 1854.

---

*On Soap as a Means of Art.** By FERGUSON BRANSON, M.D., Sheffield.†

Several years ago I was endeavoring to find an easy substitute for wood engraving, or rather to find out a substance more readily cut than wood, and yet sufficiently firm to allow of a cast being taken from the surface when the design was finished, to be re-produced in type-metal

* Dr. Branson has also employed bees' wax, white wax, sealing wax, lacs, as well as other plastic bodies; and in some of these cases a heated steel knitting-needle, or point, was substituted for the ivory knitting-needle.—ED.

† From the London Artizan, February, 1854.

or by the electrotype process. After trying various substances, I at last hit upon one which at first promised success, viz., the very common substance called soap, but I found that much more skill than I possessed was required to cut the fine lines for surface printing. A very little experience with the material convinced me that, though it might not supply the place of wood for surface printing, it contained within itself the capability of being extensively applied to various useful and artistic processes in a manner hitherto unknown. Die-sinking is a tedious process, and no method of die-sinking, that I am aware of, admits of freedom of handling. A drawing may be executed with a hard point on a smooth piece of soap almost as readily, as freely, and in as short a time as an ordinary drawing with a lead pencil. Every touch thus produced is clear, sharp, and well defined. When the drawing is finished, a cast may be taken from the surface in plaster, or, better still, by pressing the soap firmly into heated gutta percha. In gutta percha several impressions may be taken without injuring the soap, so as to admit of "proofs" being taken and corrections made—a very valuable and practical good quality in soap. It will even bear being pressed into melted sealing wax without injury. I have never tried a sulphur mould, but I imagine an impression from the soap could easily be taken by that method. The accompanying specimens will show, that from the gutta percha or plaster cast thus obtained, a cast in brass, with the impression either sunk or in relief, can at once be taken. If sunk, a die is obtained capable of embossing paper or leather; if in relief, an *artistic* drawing in metal. This suggests a valuable application. The manufacturer may thus employ the most skilful artist to make the drawing on the soap, and a fac-simile of the actual touches of the artist can be reproduced in metal, paper, leather, gutta percha, or any other material capable of receiving an impression. By this means even high art can be applied in various ways—not a translation of the artist's work by another hand, as in die-sinking, but the veritable production of the artist himself. One of the specimens sent is a copy of Sir E. Landseer's "Highland Piper," a rude one, I must confess, though its rudeness does not militate against the principle involved in its production. Suppose the drawing had been made by Sir E. Landseer himself, that accomplished artist's actual drawing might have been embossed on various materials in common use, and disseminated amongst thousands, thus familiarizing the eyes of the public with high art, and giving a value to the embossed transcript which no translation by the die-sinker, however skilful, could possibly give it. The raised gutta percha impression of this specimen is from the soap itself; the sunk impression is cast in gutta percha from gutta percha. The works in metal, during the 14th, 15th, and 16th centuries, owe their excellence, in a great degree, to the combination in the same individual of artist and artisan. The metal was finished by the artist himself, who left the stamp of his genius unmistakably upon it. By the plan just explained, something like a return to this combination might be effected, and the artist would, at least, have the satisfaction of finding his own work accurately rendered, and not enfeebled, in the translation; for the art of casting in metal has of late been so much improved, that little difference can be detected between the impression on the cast and

the mould which produced it. I wish to lay particular stress upon the fact that *drawing touches* can be thus rendered, and an effect *rapidly* produced, unattainable by modelling. The larger plaster casts were taken from drawings freely made—as the appearance of the touches will prove—in common brown soap. The finer kind of soap is, of course, better fitted for fine work; but should the process now described be adopted by the manufacturer—and I trust it may never become the subject of any patent—soap better suited to the purpose than any now made will doubtless be specially manufactured. In proof that fine lines can be drawn upon the soap as well as broad vigorous touches, I can state that one of Rembrandt's etchings has been copied on soap, the soap pressed into gutta percha, and an electrotype taken from the gutta percha cast, from which a print has been obtained, very little inferior in delicacy to the original etching. Doubtless, persons engaged in manufactures will see applications of the process which I have not contemplated, and I leave it to their ingenuity to discover them. I would particularly call the attention of ornamental leather and paper manufacturers, bookbinders, and, possibly, manufacturers of china, to the process; for it must be remembered that soap, when made, can be run into moulds of any form, so as to obtain curved as well as flat surfaces for the artist to draw upon. It has also occurred to me that it would prove a very ready and expeditious method of forming raised maps, pictures, and diagrams for the use of the blind. The manipulation is very simple. A lead pencil drawing, if required, can readily be transferred to the smoothed surface of the soap, by placing the face of the drawing on the soap and rubbing the back of the paper; every line of the drawing is then distinctly visible on the soap. The implements used are equally simple: all the specimens sent were drawn with ivory knitting-needles, and small ivory netting-meshes for scooping out larger and deeper touches. The only caution necessary is to avoid under-cutting. Having felt the greatest interest in the establishment of schools of design, so well calculated to re-connect fine art with manufactures, it will afford me sincere gratification if the simple process now pointed out—and I trust its simplicity will be no bar to its being carefully tested—shall be in the smallest degree instrumental in accomplishing the re-union.

Sheffield, December 31st, 1853.

P.S.—The date 1850 is on some of the illustrative specimens.—*Journal of the Society of Arts.*

Identity of Dynamic or Voltaic Electricity with Static or Frictional Electricity. By Professor FARADAY.*

The Friday evening meetings for the season commenced at the Royal Institution on Friday last, the opening lecture being delivered by Professor Faraday to a very crowded audience. The subject was the developement of electrical principles produced by the working of the electric telegraph. To illustrate the subject, there was an extensive apparatus of voltaic batteries, consisting of 450 pairs of plates, supplied by the Electric

*From the London Mechanics' Magazine, January 7.

Telegraph Company, and eight miles of wire, covered with gutta percha, four miles of which in coils were immersed in tubs of water, to show the effects of submersion on the conducting properties of the wire in submarine operations. The principal point which Professor Faraday was anxious to illustrate, was the confirmation which experiments on the large scale of the electric telegraph have afforded of *the identity of dynamic or voltaic electricity with static or frictional electricity.* In the first place, however, he exemplified the distinction between conductors and non-conductors, impressing strongly on the audience that no known substance is either a perfect conductor of electricity or a perfect non-conductor, the most perfect known insulator transmitting some portion of the electric fluid, whilst metals, the best conductors, offer considerable resistance to its transmission. Thus the copper wires of the submarine electric telegraph, though covered with a thickness of gutta percha double the diameter of the wire, permit an appreciable quantity of the electricity transmitted to escape through the water; but the insulation is, nevertheless, so good that the wire retains a charge for more than half an hour after connexion with the voltaic battery has been broken. Professor Faraday stated that he had witnessed this effect at the Gutta Percha Works, where one hundred miles of wire were immersed in the canal. After communication with a volatic battery of great intensity, the wire became charged with electricity, *in the same manner as a Leyden jar*, and he received a succession of forty small shocks from the wire, after it had been charged and the connexion with the battery broken. No such effect takes place when the coils of wire are suspended in the air, because in the latter case there is no external conducting substance. The storing-up of the electricity in the wire when immersed in water is exactly similar to the retention of electricity in a Leyden jar, and the phenomena exhibited correspond exactly with those of static electricity, proving in this manner, as had previously been proved by charging a Leyden jar with a volatic battery, that dynamic and static electricity are only different conditions of the same force; one being great in quantity, but of low intensity, whilst the latter is small in quantity, but of great intensity. Some interesting facts connected with the conduction of electricity have also been disclosed by the working of the submarine telegraph, which Professor Faraday said confirmed the opinion he had expressed twenty years ago, that the conducting power of bodies varies under different circumstances. In the original experiments by Professor Wheatstone, to ascertain the rapidity with which electricity is transmitted along copper wire, it was found that an electric spark passed through a space of 280,000 miles in a second. Subsequent experiments with telegraph wires have given different results, not arising from inaccuracy in the experiments, but from different conditions of the conducting wires. It has been determined that the velocity of transmission through iron wire is 16,000 miles a second, whilst it does not exceed 2700 miles in the same space of time in the telegraph wire between London and Brussels, a great portion of which is submerged in the German Ocean. The retardation of the force in its passage through insulated wire immersed in water is calculated to have an important practical bearing in effecting a telegraphic communication with America; for it was stated that, in a length of 2000

miles, three or more waves of electric force might be transmitting at the same time, and that if the current be reversed, a signal sent through the wire might be recalled before it arrived at America. Professor Faraday concluded by exhibiting a beautiful experiment illustrative of the identity of volatic and frictional electricity. The terminal wires of a powerful secondary-coil apparatus were placed seven inches apart within the receiver of an air pump, and when the receiver was exhausted, a stream of purple colored light passed between the wires, resembling, though more continuous and brilliant, the imitation of the aurora borealis produced when an electric spark is passed through an exhausted glass tube. The volatic power employed to produce this effect of static electricity was only three cells of a Grove's battery.

Researches on Evaporation. By Professor Marcet, of Geneva.*

The following experiments were instituted with the view of throwing some light on the tendency of certain circumstances to promote or diminish the evaporation of liquids. Water and alcohol were the liquids chiefly used. The results obtained by the author may be recapitulated as follows:—

1. The temperature of a liquid, allowed to evaporate freely in an open vessel, is always inferior to that of the surrounding atmosphere. The higher the temperature of the atmosphere, the greater is the difference between its temperature and that of the liquid exposed to evaporation. Between 40° and 50° Centigrade the difference was found to vary from 5° to 7°; between 20° and 25° it varied from $1\frac{1}{2}$° to $1\frac{1}{4}$°; at 12° it was 0·8° only, and between 3° and zero about 0·2°. The explanation of this result is obvious. The evaporation of a liquid diminishing with the external temperature, the cold, which is the consequence of this evaporation, must diminish in the same proportion; and if it were possible to prevent evaporation altogether, the author presumes that there would be no difference whatever between the temperature of a liquid and that of the surrounding medium.

2. The temperature of liquids, such as water and alcohol, as well as the rapidity with which they evaporate, varies, all other circumstances remaining the same, according to the nature of the vessel in which these liquids are contained. For instance, the temperature of the surrounding atmosphere being from 15° to 20°, water is, on the average, 0·3° warmer in an open metallic vessel than in a similar one of polished porcelain, and 0·2° warmer than in a similar one of glass. It is the same with alcohol. Again, both water and alcohol evaporate more rapidly from a porcelain vessel than from a metallic or glass vessel of precisely the same size. For example—three similar vessels, one of metal, the second of porcelain, and the third of glass, containing each 600 grains of water, having been exposed to evaporation during seven days, the temperature of the surrounding atmosphere varying from 20° to 25°, it was found, that at the end of that time, the porcelain vessel had lost 303 grains of its previous weight, the metallic one 277, and the glass vessel 275·5

* From the London Repertory of Patent Inventions, January, 1854.

grains only. The author enters into considerable detail as to the precautions he took to make sure that these differences could not be attributed to any difference in the radiating or conducting powers of the vessels employed.

The differences observed in the temperature of liquids, according to the nature of the vessels in which they are contained, depends, no doubt, on the property with which these vessels appear to be endowed, of accelerating or delaying evaporation. It is evident, that in each case the quantity of sensible heat subtracted from the liquid, or, in other words, the diminution of its temperature, must be in proportion to the quantity of vapor formed. For instance, the fact that water and alcohol are constantly colder in a porcelain vessel than in a similar vessel of metal or glass, is the natural result of the more rapid evaporation of these liquids from the former of these vessels than from the two latter. The reason why a porcelain vessel evaporates more freely than a metallic or glass one is far less evident. The author has proved, by placing a hermetically-closed bottle of porcelain, containing water, under the vacuum of the air pump, that it cannot be owing to any perviousness of the sides of the vessel, as he was at first inclined to suspect.

3. The influence of the mass or depth of a liquid was next examined. The author's experiments appear to lead to the curious fact, that the rapidity with which any given liquor evaporates depends not only on the extent of its surface, but also, within certain limits, on its depth. He found, for instance, that with two similar cylindrical porcelain vessels, containing, the first a layer of water of one-twelfth of an inch in depth, and the second a layer of half an inch, the evaporation from the latter exceeded that of the former in the proportion of nearly 4 to 3. A similar result was obtained with alcohol. If thin glass vessels were used, the same increase of depth accelerated the evaporation in the proportion of 6 to 5. As the author himself observes, this apparent influence of the depth of a liquid on its evaporation, may, very possibly, be merely owing to the greater facility with which the different layers are conveyed, one after the other, to the surface, when the liquid is of a certain depth than when it is quite shallow.

4. Water containing a solution of salt in about the same proportion of sea water, evaporates less rapidly, and, consequently, produces less cold than the same quantity of distilled water. The higher the temperature of the surrounding atmosphere, the greater the difference between the quantities of sȧlt and fresh water evaporated in a given time, under similar circumstances.

5. A given quantity of water, mixed with certain pulverulent substances, such as a siliceous sand, for the particles of which it has but a slight adhesion, evaporates more rapidly than the same quantity of distilled water *alone*. The fact was ascertained in the following manner:— The author, having procured two small porcelain vessels, exactly of the same size, introduced into one of them 300 grains of distilled water, and into the other a small quantity of siliceous sand, over which 300 grains of water were poured, so as not only to saturate the sand, but also to leave a layer of water of about one-tenth of an inch in thickness over and above its surface. At the end of five days, it was observed that the

water standing alone had lost 184 grains of its previous weight, while the water mixed with the sand had lost no less than 196 grains. The average difference, resulting from a series of experiments, was $7\frac{1}{2}$ per cent. in favor of the more rapid evaporation of water mixed with sand compared with that of water standing alone. If the experiment be made with glass or metallic vessels, the difference is only about $4\frac{1}{2}$ per cent.

6. The last result which we shall mention, and which may be regarded as a direct consequence of the preceding one, is the following:—Water mixed with sand remains habitually at a slightly lower temperature than an equal surface of water standing alone. The difference varies to a certain extent, according to the nature of the vessels in which the experiment is performed, never, however, exceeding half a degree Centigrade. It is greater when the comparison is made between water and wet sand placed in two similar metallic vessels, than when they are placed in porcelain or glass vessels; in the latter case it seldom exceeds 0·1° to 0·2°.

The author concludes by remarking, that the foregoing result tends to confirm an opinion expressed some time since by Professor De la Rive, in a letter to M. Arago, published in the *Comptes Rendus de l'Académie des Sciences* for October, 1851. In this letter, M. De la Rive attributes the sudden appearance of vast glaciers in divers parts of Europe to a temporary refrigeration produced at the period of the elevation of the most recent European strata, by the evaporation of the water with which they were previously covered. If, as the author's experiments tend to show, evaporation takes place more rapidly from water mixed with sand, earth, or any similar substance than from a surface of clear water, it becomes natural to conclude, that the cold produced by evaporation from the recently-elevated and still humid strata, must have been greater than that resulting from the evaporation of the sea or freshwater lake which covered them previously to a great depth.—*Bibliothèque Universelle, April*, 1853.

Translated for the Journal of the Franklin Institute.

Cast Iron for Artificial Magnets.

M. Crahay found, several years ago, that cast iron may acquire, by tempering, a coercitive force sufficiently great to allow it to be strongly and permanently magnetized. The grey iron is the best for this purpose. The pot metal is too brittle, and the first quality of cast iron gives but moderate results.

The permanence of the magnetism depends on the temper. A bar tempered at a dull red heat, may be powerfully magnetized, but loses its force in twenty-four hours. If the tempering is done at a red heat, the bars not only will take a powerful magnetism, but keep it indefinitely. Experiment has shown, that the following is the best mode of tempering large bars. They are to be heated to redness in a wind furnace, then withdrawn, one by one, the two faces of the bar are sprinkled for three-fourths of their length with yellow prussiate of potassa, and immediately plunged into a great mass of cold water, stirring it about violently.

A little more thickness should be given to bars of cast iron than to steel.—*Proceedings of the Royal Academy of Belgium, 29th July*, 1853. *L'Institut, 9th November*, p. 379.

For the Journal of the Franklin Institute.

Particulars of Several Steamers, the Machinery of which are built by Messrs. Reaney, Neaffie & Co., of Philadelphia.

Steam tug for Wilmington, N. Carolina; hull built by Linn and Byerly, Philadelphia.

Hull.—		
Length on deck,		94 feet.
Breadth of beam at midship section,		20
Depth of hold,		8 "
Length of engine space,		33 "
Engine.—One—Condensing, vertical direct acting.		
Diameter of cylinder,		30 inches.
Length of stroke,		26 "
Maximum pressure of steam in pounds,	30	
Cut off at half stroke.		
Boiler.—One—Return flue.		
Length of boilers,		20 feet.
Breadth "		7 " 6 inches.
Height " exclusive of steam drum,		8 "
Number of furnaces,	2	
Breadth of furnaces,		3 "
Length of grate bars,		5 " 3 "
Propeller.—		
Diameter of screw,		7 feet 9 inches.
Length of screw,		5 " 3 "
Number of blades,	4	

Steam tug *Walpole;* hull built by Bideman and Watson, Philadelphia.

Hull.—		
Length on deck,		94 feet.
Breadth of beam at midship section,		22 "
Depth of hold		8 "
Length of engine and boiler space,		36 "
Engine.—One—Condensing, vertical direct acting.		
Diameter of cylinders,		32 inches.
Length of stroke,		30 "
Maximum pressure of steam in pounds,	30	
Cut off at half stroke.		
Boiler.—One—return flued.		
Length of boilers,		21 feet.
Breadth "		8 " 3 inches.
Height " exclusive of steam drum,		8 " 6 "
Number of furnaces,	2	
Breadth "		3 " 6 "
Length of grate bars,		5 " 3 "
Heating surface,		980 square feet.
Propeller.—		
Diameter of screw,		8 feet 6 inches.
Length "		5 " 9 "
Number of blades,	4	

Ferry boat for Camden and Absecom Railroad Company; hull built by T. Byerly, Philadelphia.

HULL.—			
Length on deck,		100 feet.	
Breadth of beam at midship section,		22 "	
Depth of hold,		9 "	
Length of engine and boiler space,		33 "	
ENGINES.—One—Inclined, condensing.			
Diameter of cylinders,			28 inches.
Length of stroke,		7 feet.	
Maximum pressure of steam in pounds,	25		
Cut off at half stroke.			
BOILER.—One—Flue and return tube.			
Length of boiler,		20 feet.	
Breadth "		7 "	6 inches.
Height " exclusive of steam drum,		8 "	
Number of furnaces,	2		
Breadth "		3 "	
Length of grate bars,		5 "	6 "
PADDLE WHEELS.—			
Diameter of water wheel,		17 feet.	
Length of boards		7 "	
Depth "			15 inches.
Number "	11		

Steamer *J. R. Hammitt*, for Laguyra and Porto Cabello Steamship Co.; hull built by J. R. Hammitt, Philadelphia.

HULL.—			
Length on deck,		116 feet.	
Breadth of beam at midship section,		24 "	
Depth of hold,		9 "	
Length of engine space,		34 "	
Contents of bunkers in tons,	15		
ENGINE.—One—Vertical, condensing, geared 2 to 1.			
Diameter of cylinder,			34 inches.
Length of stroke,			36 "
Maximum pressure of steam in pounds,	20		
Cut off at from commencement of stroke,			18 "
Average revolutions per minute, estimated,	26		
BOILER.—One—Flue and return flue.			
Length of boiler,		20 feet.	
Breadth "		8 "	
Height " exclusive of steam drum,		8 "	3 inches.
Number of furnaces,	2		
Breadth "		3 "	
Length of grate bars,		5 "	6 "
PROPELLER.—			
Diameter of screw,		7 "	6 "
Length of screw,		5 "	
Number of blades,	4		

Steamer for coasting, not named; hull built by T. Byerly, Philadelphia.

Hull.—			
Length on deck,		140 feet.	
Breadth of beam at midship section,		24 "	6 inches.
Depth of hold,		8 "	
Length of engine space,		34 "	
Contents of bunkers in tons,	15		
Engine.—One—Vertical condensing, geared 2 to 1.			
Diameter of cylinder,			34 inches.
Length of stroke,			36 "
Maximum pressure of steam in pounds,	20		
Cut off at from commencement of stroke,			18 inches.
Average revolutions per minute, estimated,	36		
Boiler.—One—Flue and return flue.			
Length of boiler,		20 feet.	
Breadth "		8 "	
Height, " exclusive of steam drum,		8 "	3 inches.
Number of furnaces,	2		
Breadth of furnaces,		3 "	
Length of grate bars,		5 "	6 "
Propeller.—			
Diameter of screw,		7 "	6 "
Length "		5 "	
Number of blades,	4		

Steam tug for Humboldt Bay and Pacific Coast; hull built by T. Byerly, Philadelphia.

Hull.—			
Length on deck,		91 feet.	
Breadth of beam at midship section,		23 "	
Depth of hold,		10 "	
Length of engine space,		35 "	
Engines.—Two—Direct acting, condensing.			
Diameter of cylinder,			24 inches.
Length of stroke,			24 "
Maximum pressure of steam in pounds,	30		
Cut off at from commencement of stroke,			12 inches.
Average revolutions per minute, estimated,	65		
Boiler.—One—Flue and return flue.			
Length of boiler,		21 feet.	
Breadth "		9 "	
Height, " exclusive of steam drum,		10 "	
Number of furnaces,	2		
Breadth of furnaces,		3 feet	6 inches.
Length of grate bars, (to burn saw mill refuse,)		7 "	
Propeller.—			
Diameter of screw,		7 feet	3 inches.
Length "		4 "	9 "
Number of blades,	4		

Remarks.—In addition to those particularized, there are in construction by the same Company, for boats varying from 50 to 85 feet in length, engines with cylinders ranging from 16×16, to 24×24, intended for towing on the Hudson, Delaware, and Mississippi rivers. Though small, these engines are enabled, from the pressure of steam employed, to develop considerable power; those of the average class frequently towing

three coal laden brigs and schooners, at the rate of three to four miles per hour in slack water; while their size makes them manageable with but few hands, thus making them economical.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, March 16, 1854.

John E. Addicks, Esq., President, P. T.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from La Societie d'Encouragement pour l'Industrie Nationale, Paris; The Society of Arts; The Royal Astronomical Society and the Institute of Actuaries, London; The Mercantile Library Association, St. Louis, Missouri; The Young Men's Mercantile Library Association, Cincinnati, Ohio; The American Institute, City of New York; J. L. Losing, Boston, Mass.; The Allegheny Valley Railroad Company, Pittsburgh, Pa.; M. W. Baldwin, Esq., and G. H. Hart, Esq., Pennsylvania Legislature; Edward Miller, Esq., Civ. Eng., George Erety, Esq., Prof. John F. Frazer, Prof. John C. Cresson, and A. B. Huston, Esq., Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for February, was read.

The Board of Managers and Standing Committees reported their minutes.

The Actuary reported the organization of the Board of Managers, and some of the Standing Committees for the ensuing year, by the election of their chairmen, and appointing the time for holding their stated meetings, as follows:

Managers,	John E. Addicks, Chairman.		
	T. J. Weygandt, Isaac S. Williams, } Curators.	2d Wednesday Evening.	
Committees.			
On the Library,	James H. Cresson, Chairman,	1st Tuesday	"
" Cabinet of Models,	Edw. P. Eastwick, "	1st Thursday	"
" Exhibitions,	John E. Addicks, "	" "	"
" Meetings,	Dr. B. H. Rand, "	2d Monday	"
" Science and the Arts,	Prof. John C. Cresson, "	2d Thursday	"

New Candidates for membership in the Institute (2) were proposed, and those candidates proposed at last meeting (5), were duly elected.

Mr. Lifler exhibited and explained a model of his improvement in carriage axles.

Mr. Leeds submitted to the meeting, a number of specimens of iron, in the form of sheets and ships' spikes, coated with copper and brass, manufactured by Mr. E. G. Pomeroy, by the process invented by him, and described in the Journal of the Institute, Vol. xxv, 3d Series, page 213. These specimens show a decided improvement in finish obtained by practice over those formerly shown.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Instruments for the Cure of Stammering.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom were referred for examination, "Instruments for the Cure of Stammering," invented by Mr. Robert Bates, of Philadelphia, Pennsylvania—Report:

That much discrepancy of opinion has prevailed as to the cause and consequent treatment of stammering. Many of the earlier writers have attributed all the varieties of this form of defective speech to some organic affection of the vocal apparatus, or malformation of the parts that compose the mouth and fauces; as, for example, hypertrophy of the tongue, a too low position of that organ in the mouth, enlargement of the tonsils, uvula, &c. The treatment based upon these erroneous and limited views as to the cause, was necessarily as various as it was unsuccessful. Thus rollers were placed under the tongue, to obviate its fancied depression, (Mad. Leigh's treatment;) the tonsils and uvula were excised, deep gashes made in the tongue to lessen its size, &c. Others, again, traced the defect to a want of nervous power in the tongue, occasioned by paralysis of the ninth nerve, and attempted to overcome it by the use of stimulating masticatories, electricity, &c.

In all these instances it is obvious that a *special* was mistaken for a *general* cause.

A more accurate knowledge of the anatomy and physiology of the organs of phonation led to an improvement on the above restricted conjectures. Schulthess, Arnott, Müller, and several other very eminent physiologists, maintained that stammering, in all its varieties, is dependent for its immediate cause upon a *spasmodic closure of the glottis*, producing a sudden arrestation of the issuing column of air.* Later researches, however, have shown that this is true of the guttural sounds only.

Dr. Carpenter† is disposed to consider that the proximate cause, in the majority of cases, is a disordered action of the nervous centres of a centric origin. This is proved by the close analogy which prevails between the phenomena of stammering and those of the general disease, chorea. The great difficulty, in by far the largest number of cases, is to be sought for in the *spasmodic action of certain of the muscles concerned in the production of voice and in articulation*, which spasmodic action impedes or entirely arrests the column of sounding breath. This view is particularly contended for by Dr. Dunglison.‡

Dr. Arnott§ proposes, as a cure for the disease, that the patient should connect all his words by a vocal intonation, in such a manner that there shall be no stoppage of breath. This is, undoubtedly, the correct principle, although it often fails in consequence of the method advocated, not being able to carry out the principle in all cases. This was observed by Müller, who admits that the plan is founded on a sound physiological view of the nature of the affection, but urges the very proper objection, that though it may and does afford some benefit, it cannot do everything,

*Müller.—Elements of Physiology.

†Carpenter's Principles of Human Physiology.

‡Medical Examiner, July, 1852.

§Elements of Physics, Vol. I.

since the main impediment occurs in the middle of words themselves. This is a legitimate objection, as shown by the fact, that the temporary inability to enunciate may occur at the commencement of either syllable of a word, especially those commencing with a consonant; the vowels being formed between the vocal cords, and issuing without change, while the consonants require for their enunciation difficult and often complex and delicate movements of the muscles concerned in articulation.

Mr. Bates, by an independent course of investigation and observation upon himself and others laboring under stammering, has arrived at the same conclusion concering the difficulty to be overcome as is entertained by the modern physiological school.

The instruments invented by him are all based upon the same principle, and, in the opinion of the committee, are more efficient in obviating the vocal defect in question than any other contrivance or method with which they are acquainted. As the spastic difficulty obviously accompanies different sets of letters in different persons, Mr. B. has invented three varieties of instruments, as applicable to all the forms of stammering, all having the same object in view, however—the maintenauce of an uninterrupted current of sonorous breath.

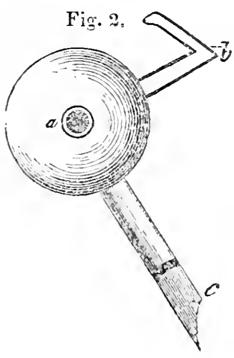
His instruments are as follow :—

Fig. 1.

1. A narrow, flattened tube of silver, $\frac{7}{8}$ths of an inch in length, very light, thin, and smooth. The diameter of the calibre of the tube, measured from the inner edge of one side to the inner edge of the other, is $\frac{3}{8}$ths of an inch, while the depth, measured from the anterior inner edge to the posterior, is $\frac{1}{16}$th of an inch. This is applied to the roof of the mouth, in the median line, in such a manner that the anterior end is lodged just behind the teeth, while the posterior opens into the mouth, looking upwards and backwards towards the fauces. In this position it is maintained by a delicate piece of wire or thin slip of india rubber fastened to one end of the tube, the other passing between the incisor teeth of the upper jaw.

This tube is intended to overcome the difficulty in the pronunciation of the linguo-palatal letters, which are formed by the application of the tongue to the palate. This it accomplishes by preserving a continuous current of air, thereby preventing spasm, allowing the letter in fault to be properly elicited, and thus restoring the self-confidence of the sufferer.

Fig. 2.

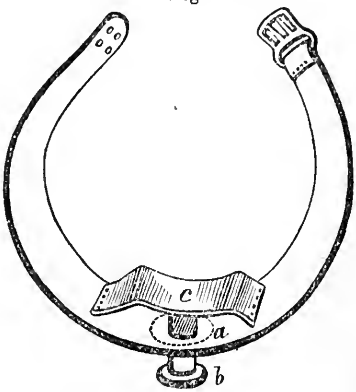


2. For the explosive consonants, the labials, dento-labials, &c., the contrivance consists of a hollow, bi-convex disk, from one end of which projects a silver tube, which, passing out between the lips, keeps up the communication between the atmosphere and the oral cavity. The current of air from the glottis enters by means of a small hole (a) at one side of the disk, and escapes through the silver tube. Finding that the saliva was apt to accumulate in the disk, and thus obstruct the entrance and exit of air, the inventor has re-

cently substituted for this lateral opening a small tube, (b,) passing from the upper edge of the disk, and bent at an acute angle upon itself.

3. For the accurate elimination of the guttural sounds, Mr. B. has contrived a belt, made of patent or glazed leather, or any other strong material, and lined with morocco. This belt is concealed in an ordinary stock or cravat, and in this manner secured around the neck. In the middle and on the anterior surface of this belt is fitted a metallic plate (a), through which passes a regulating screw (b). On the inner side of the belt, and just opposite the plate, is a metallic spring (c), covered with kid or any other soft material, and firmly sewed by both ends to the strap. When this apparatus is adjusted about the neck, the regulating screw resting upon the spring causes the latter to be forced inward, so as to press more or less strongly upon the thyroid cartilage, thus relaxing the rima-glottidis by approximating the thyroid to the arytenoid cartilages. In this manner the exit of air is provided for, and the spasmodic action of the muscles that close the glottis is overcome. The pressure upon the larynx can be increased or diminished, as may be required.

Fig. 3.



From the above description it will be seen that the efficiency of these instruments is entirely dependent upon the unobstructed channel which they preserve for the egress of the vibrating column of breath from the larynx, through the mouth, into the open air. Muscular spasm is necessarily removed, and the self-confidence of the stammerer restored—undoubtedly the great desideratum in this affection. When the patient is fully convinced that he can really enunciate the opposing letters as distinctly as his friends, he rapidly overcomes the disease, by the judicious and effective exertions which renewed confidence begets.

An advantage of some importance possessed by this apparatus is, that it can be worn without attracting notice, two of the pieces—the tube for the palatal and the belt for the guttural sounds—being entirely concealed; while the tube which projects externally from the silver disk may be disguised by slipping over it the barrel of a quill, cut like a tooth-pick. (Fig. 2, c.) Moreover, each of the pieces can be most easily and expeditiously applied, as occasion may require.

In consideration of the advantages here set forth, the committee would recommend that the first premium be awarded to Mr. Bates, for the instruments deposited by him at the last Exhibition of the Institute; and furthermore, that the Scott legacy premium be awarded him for his ingenious and useful invention.

By order of the Committee,

WILLIAM HAMILTON, *Actuary.*

January 12th, 1854.

BIBLIOGRAPHICAL NOTICE.

The Art of Manufacturing Soaps, including the most Recent Discoveries, &c. By Philip Kurten. Lindsay & Blakiston, Philadelphia, 1854.

If the quantity of soap used by a nation is an index of its advance in civilization, as a celebrated chemist humorously hints, the issue of works upon the manufacture must tend towards that progress. Certain it is that a large proportion of the comforts of civilized life flow from the extensive use of soap, at least indirectly, and that not simply from its use as a cosmetic, as might be primarily inferred, but from its more extended employment in the arts of dyeing, calico printing, &c., and its immediate connexion with the manufacture of candles. We therefore welcome works like the present, which may tend in some degree to improve the art of soap making.

The present work is eminently practical in its character, we might more justly say, purely technical; and in this regard will be welcome to those engaged in the art. We rather regret that so small an amount of chemical names and theory is introduced, because numbers of our manufacturers are capable of understanding chemical terms, and applying its theories to practice, and because it will unquestionably tend to the advancement of the art, to substitute rational for empirical processes. The publishers do not state whether they procured a translation of the work from the German, or whether it is a reprint of an English work. This we most emphatically object to as a wrong to the public. Since they have not done this, we must heap the serious errors in the work upon them. To specify a few points: What is the sense of "oxydated acid of alkali," page 13, which we suppose from the context may mean oxalic acid, or binoxalate of potasa? Is not "sulphuric clay," p. 62, a shocking translation of sulphate of alumina? "Black magnesia," p. 102, we suppose to be intended for black oxide of manganese. But what is the sense conveyed in p. 108, "sulphuric oxyde or iron"? We are left to worse than conjecture; for if the manufacturer were to employ copperas, he might ruin a batch of soap, because the author may have meant something different.

In like manner the "King's English" is often murdered, as on p. 98, "falsification on a grand scale," for the better and more technical expression, "adulteration on a large scale;" and in frequent places (p. 102, &c.) the term "opposition" is used for "competition". Now we believe the manufacturer expects and is not seriously affected by competition, but he would be extremely annoyed by the opposition of his brother manufacturers.

But while we find great fault with the style, we heartily welcome the matter of the book, as embracing the experience and knowledge of a foreign manufacturer; and which, without detracting from our own, is an addition to it. The work is chiefly devoted to the newer processes of the art, some of which are already known to us, and some are novel. The value of the last will be best ascertained by trials, which can only be performed by the experienced manufacturer.

The typography of the work is excellent, and the public is indebted to the enterprising publishers for its issue.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

MAY, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America. By John C. Trautwine, Civ. Eng., Philad.

(Continued from p. 231.)

Widths and depths of the Atrato between the Napipi and Quibdo, a distance of 85 miles.

After passing the Caño Tadía, five miles above the mouth of the Napipi, a marked improvement is perceptible in the river for some leagues. But from the number of shallow spots which occur at wide places, this circumstance would not be available for the purposes of navigation, unless in conjunction with one of those stupendous systems of engineering which, although easily effected on paper, are never found advisable in practice.

Opposite Teváda, 14 miles above the Napipi, the river is 300 yards wide; and here my soundings, reduced to extreme low-water, gave a depth of from 18 to 24 feet for three-fourths of the distance across. Although 9 feet above low-water at the time, the river was represented to be at about its ordinary stage for nearly the entire year. This would give for that stage at Tevadá, from 27 to 33 feet for three-fourths of the width. While in this condition, I found the fall to be precisely three-eighths of an inch in 500 feet, or four inches per mile; and the current in the swiftest

part, two and six-tenths of a mile per hour; although in many places above, both the fall and the velocity of the stream were considerably less than this. But at a spot just below the Bojayá, (or 4 miles below Tevâda,) where the river widens to full 400 yards, the deepest low water is 15 feet; and at another spot, 200 yards above the Bojayá, it is but 13 feet. At these points I found respectively, 24 and 22 feet for half the width, the river being at about its ordinary stage, as indicated by our tide-gauge table at the time, and afterwards verified by our observations at Quibdó, for the space of two months.

About 13 feet, therefore, would be the shoalest deduced low-water channel-depth that would necessarily be encountered between the Napipi and the Beté, which is 62 miles above it, or 23 miles below Quibdó.

At the town of Beté, about half a mile below the mouth of the river of the same name, I found the Atrato to be contracted by a gravel bluff to but 620 feet width in its ordinary stages; or a little narrower than at any intermediate point above the Napipi. For one-half this width the extreme low-water depth would vary from 16 to 26 feet, or about 13 feet less than when we sounded in from 29 to 39 feet water, the river being rather high at that time.

The Atrato makes a very sudden bend at Beté, and the current swept strongly around it, especially on the concave side, where I found the fall for a short distance to be at the rate of 19 inches per mile. Nowhere else below Quibdó did I find a rate of fall exceeding $6\frac{3}{4}$ inches per mile, and that only for short distances in contracted spots. Even at Quibdó, when the river was 18 feet above extreme low-water mark, my level showed a fall of but ·024 of a foot in 515 feet, or about 3 inches per mile, with a current of just 3 miles per hour.

The Beté is an insignificant stream. When we passed it, its mouth was 150 feet wide, but the soundings indicated that in very low stages it must be reduced to a mere run, or gutter, nearly dry; and this was sustained by the Patron and bogas, who had seen it so reduced as barely to admit a canoe.

From some three miles above the Beté, the Atrato rapidly becomes more shallow; and although there are yet many spots below Quibdó having an extreme low-water channel of 8 or 10 feet, still, there are also many where it does not exceed 3 or 4 feet, and that only in narrow, circuitous channels, along which the river boats have to feel their way with care when they happen to encounter one of the short and unfrequent periods of very low stages of water. Sometimes, indeed, although drawing but 3 or $3\frac{1}{2}$ feet, they have been obliged to unload a part of their cargoes into canoes some miles below Quibdó.

Six miles below Quibdó, at a spot called Peñon de Estrélla, the Atrato is contracted from a width of 650 feet to one of 385 feet. On the East, or concave side, is a small isolated hill, perhaps 75 feet high, and consisting of stiff red clay, gravel, pebbles of basalt, &c.; on the west convex side is the levee of mud, leaves, and sand, about 20 feet above low-water. At this place we found the swiftest current we had yet met with, viz.: full $3\frac{1}{2}$ miles per hour. This, I suspect, must be increased to about 4 miles, in very high floods. The spreading of the water on overflowing the levees, would prevent it from being much more than that. My sound-

ings here gave a depth of 24 feet nearly all the way across, corresponding to an extreme low-water depth of 15 feet. At 400 yards below the Peñon, we found 12 feet, and that only for a small part of the width; so that at extreme low stages, the greatest depth at that spot is but 3 feet, while a great portion of the width is nearly dry. The same is the case in many spots between this and Quibdó, as well as at Quibdó itself, where, *for a few days* every year, the river is fordable by boys.

I was assured by several intelligent persons in Quibdó, that the Atrato at that place was not lower than at the time of our arrival, (namely, 11 feet maximum depth,) for more than 30 days in the year; but from my own observations for two months, I have every reason to consider my informants mistaken on this point. Once during our stay the maximum depth was reduced to $6\frac{1}{2}$ feet for three or four consecutive days; and once, to but 5 feet for two days, exposing, on both occasions, sand-bars, logs, &c., in the bed of the river.

The *very uncommon occurrence* of three successive days, with no rain, except trifling showers at night, had immediately preceded, and had produced the lowest of these two stages of water. It is therefore altogether inferable, that a less depth than about 7 feet does not occur at Quibdó for more than thirty days in the year.

The ordinary stages, which we had an opportunity of observing for two months, afforded a good steamboat channel-width, with maximum depths ranging from time to time, between 10 and 16 feet. The fluctuations of the river are incessant, and altogether irregular, except that in every year there occur two periods, each of from two to five weeks in duration, pending which, the river at Quibdó is liable to be reduced to its lowest stages several times, and for some days at a time. These are in June, (sometimes the end of May, or beginning of July,) and in February (sometimes the end of January, or beginning of March.)

The river repeatedly rose or fell, 2, 3, or 4 feet in the course of twelve hours, during our stay; the most sudden risings generally occurring in the night.

The width of the Atrato opposite Quibdó, is 850 feet. The current is about $2\frac{3}{4}$ miles per hour in the swiftest part of the section when the maximum depth is from 8 to 12 feet; and 3 miles per hour when about 20 feet deep. The latter is the greatest velocity that I observed at any time at Quibdó; and about as great as at any other point above or below, except Peñon de Estrélla, where it was full $3\frac{1}{2}$ miles, and where it doubtless becomes about 4 miles per hour in high floods.

Mr. M'Cann descended the Atrato from Quibdó (in a Carthagena trading boat) by the force of the current only, except a little occasional rowing to avoid running ashore. The time consumed in so doing was 107 traveling hours, by day and by night. This gives for the *average* velocity of the current between Quibdó and the mouth of Caño Coqúito, a mere trifle over two miles per hour, assuming, as I have done, that Quibdó is 220 miles above said mouth.

I regard this as a satisfactory proof that my estimate of distances is very approximately correct. But for the occasional rowing, the velocity of the boat would have averaged probably a trifle less than two miles per hour.

Before speaking more fully of Quibdó, I will recommence at the Napipi, in order to introduce some few points that have been passed over.

Three and a half miles above the Napipi (See Plate VI., Map,) is the little Island of Napipicíto, about half a mile in length, and the first one met with above the bocas, except the Island of Tadiá. A mile above Napipicíto, on the east side of the river, is the southern entrance to Caño Tadiá, which extends to Vigia Curbaradór, enclosing between itself and the Atrato the Island of Tadiá, 42 miles in length. This caño abstracts perhaps one-third of the entire volume of water from the main stream, and thereby materially injures its character for navigation, for that distance.

Ten and a half miles above the Napipi, or 146 miles from the Gulf of Urabá, the River Bojayá (pronounced Bo-ha-yá) enters the Atrato from the west. This stream has been suggested as preferable to the Napipi for the purpose of an inter-oceanic canal. We examined it only for a mile and a half. At this distance from its mouth we found a width of about 100 yards, with a channel varying from 15 to 24 feet in depth, for one-half that distance across. The river was 9 feet above its lowest stage, which occasionally reduces the foregoing depths to 6 and 15 feet, and the width to about 50 yards, for some days at a time. The stream is here bordered by wide swamps, and when the Atrato is a little high, presents quite an imposing appearance as regards width.

The natives occupy five days in ascending the Bojayá in a light potra, to near its head, on their way across to the Pacific. The potra is a very light canoe, frequently but fifteen to eighteen inches wide, and drawing but two or three inches. It resembles a piece of three inch plank hollowed out in trough-shape, and is intended for rapid traveling in very shallow water. We could never even get into one for fear of upsetting it. Mr. McCann, more determined upon success than the rest of us, made three or four desperate attempts, but always got a ducking for his trouble.

The fact that five days are required to ascend the Bojayá, and but two and a half days for the Napipi, appears to militate against the preferableness of the former. The map of Colonel Acosta represents the stream as turning to the south from the direction towards the Pacific, and running nearly parallel to the Atrato for the greater portion of its length; and I was told by natives living at its mouth, that such was the case.

I determined to examine this river, as well as the Napipi, on my return; but my subsequent observations so fully impressed me with a belief in the existence of an insurmountable partition range, between these streams and the Pacific, that I abandoned the intention.

The town of Tevàda, (see Plate VIII.,) is situated on the west bank of the Atrato, 14 miles above the Napipi; and, with the exception of Beté, is the only one before reaching Quibdó. At its southern end, is a low, isolated hill, perhaps 100 feet high, at the foot of which is the Church.

The town contains about two dozen tumble-down huts, with the usual walls of cane, and roofs of palm leaves. They all seemed to be going to ruin, without receiving any attention as to repairs. The inhabitants apparently have nothing to occupy them; and their most striking characteristic observable was an intense and unmitigated laziness. Although

the gritas, or poling cries, of our boatmen must have apprized them of our approach for at least an hour before we arrived, and the advent of a Carthagena boat is quite an event, still not a soul stirred out of his den to look at us, or came on board until we had stopped for more than an hour. Even then, I doubt whether we should have had the honor of a visit, (our boat lying as much as 20 yards from the houses,) had they not learned that the Patron had on board divers demijohns of rum for Quibdó. The very dogs were too lazy to bark at us; but silently regarded us "with one auspicious and one drooping eye," as if doubtful whether to expect a bone, or a kick.

Our efforts to procure supplies here were altogether unavailing, the result of two days' perseverance being rewarded by the purchase only of three eggs. Seeing a few cows and goats straying near the houses, we expected at least to obtain a little milk; but the eternal "no hay," (there is none,) was the reply to all our applications.

Some of those who came on board were diseased to a frightful and most disgusting degree, that effectually deprived me of my appetite for dinner, beside furnishing an unanswerable commentary on the loose state of morals prevalent here.

At Teváda, the boats bound up river generally stop for two or three days, to rest the bogas; and our Patron was not one to violate this time-honored custom.

I availed myself of this delay to devote one day to the River Murrí. This stream enters the Atrato from the West, $1\frac{1}{2}$ miles below Teváda. It heads in the foot of the mountain range known as the Cordilleras Occidentales, or Western Cordilleras. Having engaged a rancháda, or long heavy canoe, and three of our bogas to pole her, we ascended the Murrí about 7 miles, to the town of the same name.

At its mouth it is 100 yards wide; but in many places above it has double that width. At $1\frac{1}{2}$ miles above its mouth, we found it 450 feet, with a depth varying from 12 to 18 feet for one-half the distance across. At low water of the Atrato, however, the width here would be reduced to about 100 yards, and the foregoing depths to 3 and 9 feet. Three miles from the mouth, the width was still 450 feet, but the greatest depth was reduced to 12 feet, which was afforded for half-way across; and at low water would give but 3 feet.

At the town of Murrí, (Plate IX.,) 7 miles from the mouth, the stream, although reduced to but 120 feet in width, has for nearly the entire year water enough for boats as large as that in which we were traveling to Quibdó. Occasionally, however, it becomes nearly dry here, for several days at a time.

As we approached the town, the current gradually increased in force, until for the last half mile, it was a matter of difficulty to pole our rancháda against it. The stream was also beginning to be impeded by sunken trees. Beyond the town, it soon assumes the character of a torrent.

Murrí consists of a dozen poor huts, placed on a perpendicular bluff of clay and gravel, which is high enough to escape the floods of the river. It was nearly deserted at the time of our visit, all its inhabitants, except two or three, having gone further up the river, to wash for gold. This metal is found at the heads of *all* those tributaries of the Atrato which

enter it from the East. These, as well as those of the San Juan, which also furnish much gold, all have their sources in the Western slope of the Western Cordilleras. This range extends uninterruptedly through a great portion of the Republic of New Granada; and in every stream which heads in it, flowing into the Atrato and San Juan, gold is found.

Near the mouth of the Murrí, the levees are of rich vegetable mould; but from 4 or 5 miles above, they gradually change to stiff red and yellow clay, with beds of sand and gravel, intermixed with leaves, logs, &c. The rounded pebbles of the bars and bottom are chiefly of extremely hard basalt, with a small proportion of sienite, porphyry, and other igneous rocks. The bends of the stream are by no means abrupt; and some of its straight reaches afforded pretty views of the Cordilleras of Antioquia, distant perhaps some 30 miles.

While at the town, we searched for the road to Antioquia, which is laid down on the maps; but could not find it. As it is only traveled on foot, and that very rarely, it is probably an undistinguishable forest path.

On our return, the current carried us down to the Atrato in two hours, while our ascent had required four. We saw a few flocks of fine wild ducks, but they did not get within range of our guns.

There are houses built along the banks of the Murrí, at intervals of about half a mile. They are elevated above the levees, like those on the Atrato. The occupants are almost exclusively negroes, by whom clothing generally appeared to be regarded as a very dispensable superfluity.

The day after our return from Murrí being also spent at Teváda, we employed ourselves in rubbing our bodies with various decoctions of brandy and tobacco, red pepper, oil, &c., to allay the intolerable irritation, arising from thousands of *yavís*, which had inserted themselves in our skins, during a few hours' stroll on shore.

The yaví is a microscopic insect of a red color, resembling vermilion dust. I at first mistook it for the pollen of some flower; but on being assured to the contrary, I submitted it to a powerful magnifier, and found it to be apparently a species of tick. The natives do not appear to regard their attacks; but our party having become nearly covered with them, were almost thrown into fevers by the irritation. None of our applications afforded relief, and we found the best thing we could do was to rub the skin from the worst parts, and then apply spirits, for converting the itching into a smart. By this means, we managed to obtain a little sleep, although the greater part of three or four successive nights was passed in pacing the deck, in our shirts only.

About two leagues above Teváda, on the east side of the river, the Atrato has made for itself a *cut-off* across the neck of a great bend. It is called Caño Pacurucundó, and is about $2\frac{1}{2}$ miles in length, with an average width of 50 yards, and a depth of some 10 feet for one-half its width, at low stages. The fall due to the entire length of the more circuitous main stream being concentrated into the shorter length of the cut-off, of course increases the velocity of its current. We found it so strong that with the greatest exertion of the polers, we spent nearly three hours in ascending the first mile; the current would catch our boat as we attempted to cross from side to side of the caño, to avail ourselves of the less velocity at the convexities of the bends, and carry her some distance down

stream before she could be brought up by the paláncas. The boat was frequently pitched headlong into the dense undergrowth of the banks; and floating trees pitched with equal violence into her. The caño is extremely crooked, being worse in this respect than even the Napipi, except that its greater width allows a more ready passage around the bends. The Patron assured us that by taking Pacurucundó instead of the main stream, we saved several miles of distance; but I think it highly probable that this economy of space is tolerably well compensated for by increased expenditure of time and labor.

At one part of this caño, we found the branches of some of the trees completely encrusted with a green insect about an inch long, with a horn on its back. This horn was so hard that it penetrated the soles of our shoes as we accidentally trod on some of them that had been shaken into the boat as we were pitched into the bushes. We took some of them prisoners, and to prevent their escape stuck them into a board by their own horns. A few which I had preserved to bring home were accidentally lost. We saw them nowhere else.

The River Bebará enters the Atrato from the east, 46 miles above the Napipi, and like the Murrí, has its sources in the slopes of the western Cordilleras. At its mouth are some half dozen negro ranchos, and here I detained our boat a day to give me an opportunity to examine the Bebará as far as the town of the same name, a distance of 8 miles. We found it to be about 100 feet wide at its mouth, and varying from that to 150 feet all the way to Bebará; it is shallower than the Murrí, having but 6 or 8 feet at its mouth during the lowest stages, and from 10 to 12 in ordinary ones. At the town it is occasionally nearly dry; but generally affords a boat channel of from 4 to 6 feet deep. Above the town it rapidly becomes shoal, and is much obstructed by fallen trees.

The town of Bebará is situated on a low isolated hillock of clay mixed with large rolled pebbles of basalt; it is a wretched hole, like Murrí, but three times as large, inasmuch as it contains some three dozen huts. One of these is a church.

Here, also, nearly all the inhabitants (chiefly negroes) had gone up the river to search for gold. We made diligent inquiry, aided by actual search, for something to eat, but in vain; two or three lemons alone rewarded our labors. Along the banks of the stream were numerous ranchos, and we noticed far more signs of attention to cultivation than we had hitherto met with. At several of the ranchos we saw large patches of sugar-cane, plantains, and corn. The raw sugar-cane is much used throughout all this region as an article of food, and our bogas bought and ate it with great avidity whenever it was procurable. At some of the huts on the Bebará they were converting it, in small quantities, into molasses, coarse brown sugar, (called panéla,) and guarápo. The sugar, as well as the cane, is held in high estimation as an eatable. Guarápo is the expressed juice of the cane, and, when fresh, affords a quite palatable drink for a hot climate. When first made, it does not intoxicate, but after having undergone fermentation, it does so very effectually, although requiring tolerably copious libations for that purpose. On this account it constitutes an essential element in the merry-makings of the natives, by whom ardent spirits are seldom attainable. A death in a family, espe-

cially, is solemnized by most devout drinking and dancing on the part of the relatives of the dear departed. Guarápo performs important functions in these ceremonies; and I have frequently thought, while contemplating the marvellous effects of its inspirations, "blessed are they that mourn."

We stopped at two or three of the ranchos, to enable our bogas to purchase cane, sugar, and guarápo; and were uniformly received with that simple-hearted kindness that so generally characterizes these people. In their rude huts, provided with an earthen pot or two for cooking, a few calabashes to serve for plates and other utensils, a few gaudy handkerchiefs or pieces of calico, to attach to whatever part of their persons happens to comport with the taste of the lucky possessor on holiday occasions, they live happy and free from care; to-morrow is left to provide for itself, and to-day does not fare much better.

The playas, or bars of sand and gravel, exposed when the Bebará is low, showed considerable quantities of black ferruginous sand, the invariable accompaniment of gold dust. Along the banks of the stream we noticed beds of firm clay, several feet in thickness, overlying deep layers of dead leaves and branches. Near the town some of the clay banks were so indurated as to constitute a semi-rock.

As on the Murrí, our ascent occupied four hours, and our descent two. About a mile below the mouth of the Bebará, in the Atrato, is the Isla del Ingles, or Englishman's Island. I could not learn whence it had derived its name. It is about half a mile long, by 150 yards wide, pretty well cultivated, and liable to overflow.

Twenty-three miles below Quibdó, is the town of Beté, on the west bank of the Atrato. It contains nearly 40 huts, built in an irregular, straggling manner, on a somewhat singular bluff of clay and gravel, which is in some parts as much as 50 feet above low water. This gravel is the first we have seen along the banks of the Atrato.

Taking warning from our experience in Teváda, we did not indulge in a stroll here; but occupied ourselves in measuring the width of the river, leveling its fall, &c., during which we several times sunk almost to our middles in the soft black mud of the banks. We lay at Beté all night, on board our boat, as usual. The inhabitants seem, like those of Teváda, to be a dead-alive kind of mortals. No sounds of life or merriment were heard by night at either place; two or three lights might be seen burning in the town, but the deep silence was disturbed only by the agonizing groan of a bull-frog, the chirp of a katy-did, the splash of a falling tree, the mutterings of thunder, or the vigorous snoring of our bogas. These lay, every night, stretched out on the bare deck, each completely enveloped in his blanket, even to his head, insensible to heat, rain, or exposure of any kind. Some 10 miles above Beté, a little fine gravel on one of the sand playas, or bars, was the first we had seen *in* the river; but before reaching Quibdó, the grating of the paláncas on the bottom indicated large quantities of coarse gravel and rolled pebbles.

Quibdo.—At last, on Saturday afternoon, July 10th, turning a bend in the Atrato, we suddenly saw, within a mile of us, the long-desired, the much-talked-of Quibdó. A mere glance sufficed to put a most effective extinguisher upon any preconceived ideas we may have entertained of its

splendor, or even comeliness; for a view more tame, uninteresting, and destitute of the picturesque, than it presented, cannot well be imagined. —(See plate X.)

Our disappointment at its unpretending exterior did not, however, prevent us from regarding Quibdó with very especial favor. For just one month, (it seemed like six,) had we been toiling up the Atrato, at an average rate of between 7 and 10 miles per day; almost daily exposed alternately to the fierce rays of a tropical sun, and the thorough drenchings of tropical rains; deprived of almost every element that ministers to ordinary comfort, or even to the requirements of common decency; literally "cribbed, cabined, confined" in an oven, the heat of which was scarcely endurable, and reeking with that villanous compound of smells which codfish, semi-putrid jerked beef, unearthly cheese, and other odorous abominations of the cargo exhaled day and night; sleeping in shape of a note of interrogation on a piece of thin floor-matting, spread over the loose boards of the cabin floor, and shared in common by roaches, whose name was legion; tormented almost into sickness and fever by insects of microscopic dimensions, but of gigantic biting powers; constantly drinking warm water from the river, mixed with the frightful rum of the country, (most appropriately called "mata búrro," or "kill donkey;") eating our meals in a cabin three and a half feet high, where we were constrained to assume the most uncomfortable positions; and where our eyes were generally regaled with the smoke from the cook's fire, or offended by hind-shortened views of our black cook himself, perfectly naked, sitting in the entrance to our cabin, perhaps paring his toe-nails, picking his teeth with one of our forks, or vigorously scratching his well-populated head over our stereotyped dessert of boiled rice.

In a word, we were tired out; patience of ten-Job-power had been nearly exhausted; we longed for rest; and in the prospect that within an hour we should attain it, we were already forgetting our privations, when suddenly our boat brought up under full headway on a gravel bar, from which the efforts of the bogas for some hours were unavailing to remove her.

Fortunately, a passing canoe carried the tidings of our mishap to Quibdó, and a rancháda was despatched for our party by Lieut. Porras, who had been our fellow passenger as far as Teváda. At that point he had, for greater expedition, hired a rancháda, and had already arrived in Quibdó some days before us. I should gladly have followed his example, but as my object was to examine the river, I had to give the preference to the most slow and tedious mode of traveling.

As evening was approaching when the rancháda arrived, Dr. Halsted and myself determined to remain on board all night, and proceed with our boat next day; but Mr. McCann started off at once, in order, if possible, to secure a house, cook, &c., for our stay in Quibdó. He succeeded admirably, having hired a new house, just finished, one of the most commodious and pleasant in the town, beside being built on the very brink of the river's bank, thereby enabling us at all times to watch our tide-gauge from the balcony without even leaving the house. Owing to his promptness we were enabled to take possession immediately on our arrival early next morning, a rise in the river during the night having floated our boat out of her difficulty.

The position of our house was the more gratifying, as I had determined to remain at Quibdó long enough to observe the Atrato well in all its phases. We also needed recruiting before commencing our further examinations, which were to extend over some hundreds of miles, and be conducted in small canoes, in comparison with which our large river boat, bad as she was, might be regarded as a floating palace.

We had scarcely been installed in our quarters an hour, before we received a visit from Señor Nicomedes Contó, Governor of the Province of Choco, accompanied by Dr. Key, a Scotch physician, who has for many years resided here, exercising the double calling of physician and merchant. We had brought letters of introduction to both from Carthagena, and I record with sincere gratitude, that during our stay at Quibdó we received from both the most unremitting kindness, and every attention that the dictates of hospitality could suggest. Grateful as such evidences of good will are at all times, they become doubly so when, as in our case, one finds himself literally and emphatically a stranger in a strange land. They at once insisted upon sending to our house such articles of furniture as we most needed; and from them chiefly, I derived such items of information respecting the commerce of Quibdó, and other particulars, as will be found in the following pages.

For some two or three days after our arrival, we felt but little disposition to move about, having become quite stiff by the constrained positions which we had been so constantly compelled to assume during our month's voyage up the river.

Although we had all partaken fully of these inconveniences, still the greater burden fell on myself. From the time of starting, every morning at sunrise, until that of stopping for the day, at sunset, I had been standing, day after day, and week after week, exposed alternately to the sun and rain; the top of the cabin my table, taking the bearings and estimating the distances by eye, as a partial check upon our calculations by time and the rate at which our boat moved.

Dr. Halsted repeatedly proffered his services to relieve me from this fatiguing routine; but although he could have performed the duties as well as I, still, my desire to attend to all I could personally, generally prevented me from accepting his offers. On some few occasions, however, actual prostration by the heat compelled me to take an hour's respite in the cabin, where the temperature very rarely exceeded 95° Fahr.; although it reached 90° or 92° almost every day. At such times I gladly availed myself of the Doctor's assistance.

The sufferings sometimes endured from the direct rays of the sun, aided by the reflection from the water, (which latter scorched our faces in spite of our broad brimmed straw hats,) may be imagined, when I state that the thermometer in the sun repeatedly rose to over 130°, and a few times to 137°. The one which I employed outside of the cabin, was graduated only to 137°, although the range of the mercury extended a trifle above that limit. One day this instrument burst by the expansion of the mercury.

Had it not been that the prevalence of mists and clouds obscured the sun for a great portion of the time, frequently rendering the temperature delightful to persons as lightly clad as we usually were, I should have

been compelled to abandon the work of noting down the bearings and distances along the river. We could not put up an awning on account of the overhanging branches of the trees and shrubbery which were continually sweeping our deck, filling it with stinging ants, and other insects.

Very frequently we could only endure the scorching heat of the deck floor by throwing water over it at short intervals; and our guns, which lay on top of the cabin, in readiness for snakes or ducks, were kept cool enough for handling by shading them with a piece of canvas.

To be Continued.

---

*Railroad and Steamboat Accidents Compared.**

The following table from the New York *Herald*, gives all the railroad and steamboat accidents which have occurred from the 12th of January, 1853, to date:

DATE, 1853	RAILROADS. Accidents.	Killed.	Wounded.	STEAMBOATS. Accidents.	Killed.	Wounded.
January, - - -	14	25	40	4	66	33
February, - -	6	6	11	1	120	—
March, - - -	14	24	57	3	30	17
April, - - -	4	25	54	3	58	21
May, - - -	8	54	48	00	00	00
June, - - -	5	5	19	4	19	17
July, - - -	11	8	22	1	7	2
August, - -	14	35	94	2	2	5
September, - - -	18	13	35	3	8	14
October, - -	19	14	34	4	18	23
November, - - -	19	11	32	3	19	10
December, - -	8	7	37	3	13	16
Total in 1853, - -	138	227	483	31	359	158
DATE, 1854.						
January, - - -	21	10	26	8	139	20
February, - -	20	12	37	5	54	24
March, to date, - - -	11	13	78	4	148	23
Total during 14½ months, -	190	268	624	48	691	225

From this table we gather that the number of accidents upon railroads has been 396 per cent. in advance of those upon steamboats. The number of wounded upon railroads has been 270·07 per cent. in advance of those from steamboat accidents. While the number of deaths resulting from steamboat accidents is 260·50 per cent. more than upon railroads.

From this it would appear that railroad traveling was more prolific in accidents, but less serious in deaths, than steamboat traveling. But there is an element entering into this calculation which is not given here; we mean the respective number of passengers, without which it is impossible even to approximate a general average.

* From the Cincinnati Railroad Record, April 6, 1854.

AMERICAN PATENTS.

List of American Patents which issued from March 7th, 1854, *to March 28th,* 1854, (*inclusive,*) *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

MARCH 7.

1. For an *Improved Arrangement of Fusible Plugs or Disks for Steam Boilers;* Wm. Burnett, Boston, Massachusetts.

"The nature of my invention consists in a peculiar arrangement of plugs or disks of fusible alloy, which insures that they will melt with great certainty and accuracy, and by which the difficulties found in the use of such plugs or disks, as generally applied, are obviated, viz: liability to be forced from their seat, by the pressure of the steam, before the fusing point is actually arrived at, and also from being exposed to a high temperature, the great liability to have the more fusible metal of the compound, forced, by the pressure of the steam, out of the interstices of the metal combined with it, leaving a porous metal which is not easily fused, and therefore unable to perform its intended function."

Claim.—"I do not claim the application of fusible plates to steam boilers for the purpose of permitting the steam to escape when it has reached any assigned limit; nor do I claim the method described, of preventing the plate, which is remote from the boiler, from being fused by the heat of the boiler. What I claim is, the application to steam boilers, of two plates or plugs of fusible alloy, arranged as described, one of said plates being remote from the boiler, and the other to the interior thereof, by which arrangement the pressure of the steam is admitted on both sides of the interior plate, in the manner and for the purposes as specified."

2. For an *Improvement in Machines for Plastering;* Isaac Hussey, Harveysburgh, O.

Claim.—"What I claim is, the arrangement of the several parts of the machine, substantially as and for the purpose described."

3. For an *Improved Arrangement of Valve Motion for Locomotive Engines;* Caleb Cook, Nashville, New Hampshire.

Claim.—"I do not claim, for operating the valves, an arrangement, wherein a link is employed, and has attached to it the valve rod and the eccentric rod, the centre pin of the link working in the eye of a horizontal arm attached to a rocker shaft; nor do I claim a modification of such, wherein would be the same link with the eccentric rod and valve rod attached, and having the centre pin of the link moving in vertical or curved guides, attached to the rocker shaft, as such modifications do not admit of the reversing of the engine, without the removing both the link and the eccentric rod, whereas, with my improvement, such can be effected by moving the eccentric rod only. I therefore limit my claim to my particular arrangement or construction of the open lever, as provided with two recesses, and connected to a rocker shaft, and applied to, and made to operate with respect to the eccentric and valve rods, substantially as described."

4. For an *Improvement in the Gauge of Straw Cutters;* W. Gale, Louisville, Ky.

Claim.—"What I claim is, the arrangement of the adjustable gauge, as described."

5. For an *Improved Method of Opening and Closing Gates;* Wm. G. Philips, Newport, Delaware.

Claim.—"What I claim is, the double span rotating gate, opening and closing, continually formed by means of levers and inclined planes, as well as by pulleys and cords, combined and arranged as set forth."

6. For an *Apparatus for Rounding and Beveling Barrel Heads;* Joel P. Heacock, Marlborough, Ohio.

Claim.—"What I claim is, rounding and beveling a barrel head at one operation, in a very true and perfect manner, by the employment of a double-edged adjustable cutter, secured in a swinging frame, or forked lever, and moved from a vertical to a horizontal position, vice versa, back and forth from one end of the staff to the other, in combination with the clamping jaws for holding the stuff in a proper position by being operated upon, substantially as set forth and described."

7. For an *Improvement in Cotton Seed Planters;* George W. Cooper, Palmyra, Ga.

Claim.—"What I claim is, the combination of the saws and feeders, the said saws having a reciprocating rectilinear motion, and the said feeders having a reciprocating rotary motion, the above parts being constructed and arranged substantially as set forth."

8. For an *Improvement in Sash Fasteners;* Henry B. Kimble, Rochester, New York.

Claim.—"I am fully aware that a weighted lever has been used to move a sliding and independent bolt; I do not, therefore, claim the simple combination of the weighted lever with the sliding bolt; but what I do claim is, the combination of the peculiar form of the bolt, having the locking notch with a weighted lever, formed and operating substantially in the manner described."

9. For an *Improvement in Sewing Machines;* William H. Johnson, Granville, Mass.

Claim.—"What I claim is, 1st, The making of a seam with a single thread, by the combination of a single needle, forked hook, and expanding lever, operating substantially in the manner and for the purpose specified. 2d, The forming or making of a seam from a single thread by the running of a loop of the thread through the material to be sewn, the running of a second loop through the material, and putting the first loop through the second, the running of a third loop through the material, and through the first named loop, the carrying of a fourth loop through the material, and putting the third through it, and so on, putting the first loop through the second and around the third, the third loop through the fourth and around the fifth, and so on, forming the belaying double loop stitch described, in the manner set forth. 3d, The feeding of the material to be sewn, by means of a vibrating needle, by which the material is moved along, as required, for the stitch, substantially in the manner specified."

10. For an *Improvement in Sash Sustainers;* George C. Hinman, New Haven, Conn.

Claim.—"What I claim is, the sash sustainer, consisting of an arched rod attached to the horizontal part of the window in such a manner that the weight of the sash shall cause the clogged ends of the rod to bear equally on both sides. And, also, the above described lever thumb piece for increasing the arch of the rod, and relieving the pressure so as to allow the window to be lowered, the whole being arranged and operated substantially as described."

11. For an *Improvement in Reeling Machines;* George Levan, West Earl Township, Pennsylvania.

Claim—"What I claim is, the double disk, as constructed with hinged wing, for the purpose of keeping the threads regularly stretched, and operating the sliding rail when one of the threads is broken, in the manner described."

12. For an *Improvement in Sectional Dry Docks;* Samuel Loveland, Astoria, N. York.

Claim.—"I am aware that a water ballast has been used, extending from stem to stern of a life boat, for the purpose of righting the same; and I am also aware that space between separate floats is not new; but what I claim is, the transversely placed tank, trunk, or water chamber of each section of the dock, forming not only a central water ballast in the float directly under the keel of the vessel, but when empty, a dry tank, for the purpose of giving access to the keel in repairs. I also claim the tank, trunk, or chamber, in combination with the buoyant chambers or floats, hollow guards or chambers, or when combined with the chambers or floats attached to the ends of the trunk or float, in the manner set forth."

13. For an *Improvement in Tail Stocks for Turning Lathes;* L. B. Tyng, Lowell, Massachusetts.

Claim.—"What I claim is, constructing and applying guide boxes, substantially as described, to the tail stocks of lathes, which make a better, cheaper, and far more durable bearing than those made heretofore for such purposes."

14. For an *Improvement in Machines for Boring and Mortising Carriage Hubs;* R. J. R. Stone, Berlin, Ohio.

Claim.—"What I claim is, the combination and arrangement of the chisel and quadrant lever, in the manner specified, for the purpose of beating out the mortise at any desired angle, as indicated by the index. I claim this in connexion with the sliding frame, in the manner and for the purpose set forth."

15. For an *Improvement in Carriage Brakes;* Joseph Sollenberger, Higginsport, O.

Claim.—"I claim the mode of applying the fore and hind wheel rubbers, by means of the connexion applied to the fore rubber, as described, and in connexion therewith, the connexion applied to the hind rubbers, as described, so that the fore wheels may be acted on in the rear, and the rear wheels in front, substantially in the manner and for the purpose described."

16. For an *Improvement in Apparatus for Paying the Seams of Vessels;* James W. Stoakes, Milan, Ohio.

Claim.—"What I claim is, the construction of a rotary mop by the combination of the two sectional disks, provided with hollow arms or axes, through which passes a bolt having a nut, by which the disks are secured together, and the mop retained in place at the periphery, between the inside edges, or by any other means substantially the same, for the purpose set forth."

17. For an *Improvement in Suspending Eaves Troughs;* Chauncey D. Woodruff, Toledo, Ohio.

Claim—"What I claim is, the mode of suspending and fastening eaves troughs, as described."

18. For an *Improvement in Seed Planters;* Luther B. Fisher, Coldwater, Michigan.

Claim.—"What I claim is, constructing the driving wheels of planters with cut rims and divided hubs, substantially as described, said hubs being made to traverse the driving shaft, by means of forked levers, operated by a screw, or its equivalent, for regulating the aligment of the hills in a cross direction. I also claim the scraper, in combination with the pins and levers, arranged and operating substantially as described, for preserving a given space between the edge of the scraper and outer surface of the rim of the wheel."

19. For an *Improvement in Seed Planters;* Jeremiah C. Gaston, Reading, Ohio.

"My improvement consists in the peculiar construction and operation of a reciprocating agitator in the hopper, for the purpose of preventing the clogging of the seed, and to insure its discharge."

Claim.—"What I claim is, the reciprocating agitator, constructed and operating in the manner and for the purposes set forth."

20. For an *Improvement in Sewing Machines;* Charles Miller, St. Louis, Missouri.

Claim.—"What I claim is, giving the cloth or material being sewed, a movement laterally to the directions of the seam between the successive stitches or interlacings of the needle and shuttle threads, substantially as set forth, for the purpose of receiving different kinds of stitches or seams."

21. For an *Improved Method of Operating Hydraulic Rams;* Clark Polley, May's Landing, New Jersey.

Claim.—"I do not claim, in any manner, the pump or hydraulic ram; but what I do claim is, the air tight box or chamber, having within it, and in combination therewith, and with each other, substantially as set forth, the hydraulic ram and pump, and having suitable pipes attached, in such manner as that when the apparatus is submerged and the pump worked from above, the ram will be free to operate by the pressure and momentum of the water resting above it."

22. For an *Improvement in Artificial Legs;* David B. Marks, City of New York.

"My invention relates to the means by which the movements of the knee and ankle joints are controlled, and the necessary rigidity is maintained during the cessations in those movements."

Claim.—"What I claim is, the combination of the rod which is attached to the foot, and moves upwards and downwards, with the leg or lower part of the limb, the spring applied to the rod, and the curved bar, plate, or way, attached to the thigh or upper part of the limb, the whole operating, substantially as described, to lock the knee stiff, and control the position of the foot until the ankle is bent on throwing the body forward, and retain the foot in its bent position at the ankle until the knee is again straightened."

23. For an *Improvement in Brick Machines;* Seman C. Ripley, City of New York.

Claim.—"I do not claim, broadly, the use of a gauge for guiding the moulds in entering under the grating, as such a gauge, provided with a weighted lever for throwing it

back to its place on the backward movement of the force bar, has been used in the machine of Collins B. Baker, patented March 26th, 1850; but what I do claim is, throwing the gauge back to its place by means of a tail or cam, or the equivalent thereof, upon which the force bar acts on its backward movement, substantially as described."

24. For *Improvements in Machines for Splitting Ratans;* Joseph Sawyer, South Royalston, Massachusetts.

Claim.—"What I claim is, the combination of the feed rollers with the cutter, constructed and operating as described."

25. For an *Improvement in Machines for Splitting Ratans;* Addison M. Sawyer, Templeton, Massachusetts.

Claim.—"What I claim is, the employment of a tubular spurred cutter, or its equivalent, in combination with a guide for holding and guiding the stick thereto, substantially as described."

26. For an *Improvement in Sewing Machines;* William Wickersham, Boston, Mass.

Claim.—"I do not claim the mere duplication of a sewing machine, or the placing of one of such machines by the side of, or near to, another and similar machine, so as to perform two rows of stitches by the operation of both machines. But what I claim consists more properly in so combining with one sewing machine, having one needle and a thread carrier, or their mechanical equivalents, another or second needle, and a second hole in the thread carrier, or the equivalents therefor, that by the action of the same needle-moving machinery, two needles are made to operate simultaneously, so as to perform at one and the same time, two parallel rows of stitches with separate threads, substantially as specified."

27. For *Improvements in Britannia Tea and Coffee Pots;* Robert W. Andrews, Staffordville, Connecticut.

Claim.—"What I claim is, a tea pot, coffee pot, or other vessel composed of a supporting ledge, or base of iron, (or other metal which is not melted by ordinary degrees of fire heat,) combined with a body of britannia metal, substantially in the manner and for the purpose set forth."

28. For an *Improvement in Connecting the Joints of Air Heating Pipes;* J. Young, Franklin Furnace, Ohio.

Claim.—"What I claim is, forming a perfectly tight joint for air heating pipes, by boring out recesses in the ends of the pipes, the recesses being sufficiently large to receive a thimble, which is made of a more expansive metal than the pipes, and which thimble, upon being heated, will, in consequence of expanding more than the pipes, bind tight against the recesses in which it is fitted, and form a perfect tight joint, as shown and described."

29. For an *Improvement in Machines for Drilling Stone;* William C. Wright, Boston, Massachusetts.

Claim.—"What I claim is, the combination of mechanism described, for operating the drill bar, consisting of two pairs of grippers, attached to rods having slotted heads which receive the wrists of the cranks, the said cranks being arranged diametrically opposite to each other on a common axis, and the slots in the heads of the gripper rods being of such form as described, so as to cause one set of grippers to be always rising while the other pair are descending, but to cause a cessation of motion before every descent, in order to give time for the drill bar to fall."

30. For an *Improvement in Hanging Gates;* Ashley Hotchkin, Schenevus, N. Y.

Claim.—"What I claim is, hanging a gate by means of two lower turning pivots or pintles, working on separate step projections of a box or frame, the upper end of the gate being steadied and carried by rollers, (any suitable number,) or their equivalents, working or traveling in fixed rows, chambers, or spaces, so as to admit the gate opening either way; the several parts being constructed, arranged, and operating essentially for the purpose expressed, as described."

31. For an *Improvement in Water Closets;* Daniel Ryan and John Flanagan, City of New York.

Claim.—"What we claim is, 1st, Dividing the chest or penstock into two compartments,

communicating with each other, the division being made by means of a flanch, or its equivalent, by which a sufficiency of water is reserved within said chest or penstock, after the supply has been stopped, to cover the opening or mouth of the pipe at the bottom of the bowl seat, and effectually prevents the escaping of effluvia into the apartments. 2d, The sliding tube within the trunk or cylinder, said tube being constructed, arranged, and operated, as shown, by which a direct communication is at all times cut off between the bowl seat and exit pipe, and, at the same time, the excrement allowed to pass into the exit pipe at the proper time."

32. For an *Improvement in Self-Acting Railroad Switches;* Joseph Wilson, Hartford, Connecticut.

Claim.—"I do not claim the connexion of a switch and a bar by a jointed lever, so that the motion of one gives a corresponding motion to the other; nor do I claim to operate the switch by means of a bar forming part of one of the main track rails; nor do I claim to return the switch to its position by means of a spring and catch, after it has been displaced by the pressure of the flanch of the car wheel, but I limit my claim to the precise arrangement of the parts for operating the switch by means of the lateral pressure of the wheel flanches on the inner sides of the movable and fixed rails, when the cars are on the rails."

33. For an *Improvement in Sewing Machines;* Christopher Hodgkins, Assignor to Nehemiah Hunt, Boston, Massachusetts.

Claim.—"What I claim consists in constructing the horizontal needle of the angular form, substantially as described, and making it to operate with respect to the vertical needle and its eye, arranged as set forth, essentially in the manner as specified."

34. For an *Improvement in Wire Heddle Eyes for Looms;* Thomas Clegg, Assignor to himself and Nathaniel Stevens, Andover, Massachusetts.

Claim.—"I do not claim a loom harness metallic eye, or eyelet, made by being stamped out of a piece of metal; nor do I claim a metallic eye or heddle, formed by round wires, or wires twisted together. But what I do claim is, a loom harness metallic eye, made of round wire, or wires twisted together, and compressed and flattened in the twist of its wires, and directly at the top and bottom of its warp thread opening, substantially in the manner and for the purpose as described."

MARCH 14.

35. For an *Improvement in Rotary Cultivators;* George B. Field, St. Louis, Missouri.

Claim.—"I claim the construction of the rotary cultivating cylinder, made of cutting plates or spades, and interposed pushing or clearing boards for removing the earth, as described. I claim the arrangement of the shield plates, on the shaft, for the purposes set forth. I claim the arrangement of the rotary harrow, sustained above the ground, and in the rear of the cultivating cylinder, for breaking and pulverizing the falling earth, as set forth."

36. For an *Improved Saw Set;* Oliver Lesley, Attica, Indiana.

"The nature of my invention consists in the arrangement of a triangular gauge, admitting of adjustment or movement, in connexion with a swage, provided with a suitable nick or recess for receiving the tooth of the saw, in its process of sharpening and turning, while the gauge regulates the turn or hook of the tooth thus operated on; both of these devices being secured on a stock or handle, by which the implement is held when in use."

Claim.—"What I claim is, the arrangement of the triangular gauge with the swage upon the stock, for the purpose of adjusting the gauge relatively to the nick or recess in the swage, as set forth."

37. For an *Improvement in Excluding Dust from Railroad Cars;* Orrin Newton and J. A. Crever, Pittsburgh, Pennsylvania.

"Our invention consists, chiefly, in ventilating railroad cars by supplying them, when in motion, with a continuous current of atmospheric air, previously purified from dust and other foreign matter, whereby not only is the car thoroughly ventilated, but the ingress through windows and crevices in the cars, of dust, sparks, insects, &c., from outside, is prevented by the current of air which is thus caused to rush constantly out of the cars, the reverse of which is the case when the cars are not thus artificially supplied with air."

Claim.—"What we claim is, the combination of the bellows and water cistern con-

nected with each other, and with the cars, by pipes, for the purpose of ventilating railroad cars, constructed and operating in the manner described."

38. For a *Machine for Damping Printing Paper;* Andrew Overend, Philada., Pa.

Claim.—"What I claim is, 1st, The self-acting feed-board, arranged and operating as described. 2d, The arrangement and combination of the upper and lower felted rollers, for the purpose of saturating the upper roller in the intervals between the passage of the paper, in the manner substantially as described. 3d, The projections, for the purpose of breaking the bead as the paper enters, arranged and operating substantially as described. 4th, The combination of the wetting cylinders and fly, substantially as described."

39. For an *Improvement in Form of Scythes;* Joseph W. Robinson, Kirkland, N. Y.

Claim.—"What I claim is, the form which is given to the back and web of the scythe, as described, whether the web starts from the centre of the back, or elsewhere, except from the edge."

40. For an *Improvement in Mould-Boards of Ploughs;* Edwin M. Bard, Philada., Pa.

"The object of my improvement is, to break or pulverize the layers of earth at the same time that they are cut and thrown over by the mould-board, and cause the ground, when ploughed, to be thoroughly softened the full depth (or nearly so) of the cut of the plough, and, in fact, enable the plough, in its progress through the field, to perform the two offices of plough and harrow."

Claim.—"I do not claim the combination of cutters or rakes with cultivators or ploughs, for enabling the latter to perform two functions at the same time; but what I do claim is, securing the cutters in openings formed in the mould-board at the points, and in the inclined positions, outward and backward represented, so as to enable the lower forward cutters to cut and loosen the soil preparatory to its being overturned on the other cutters, to more thoroughly pulverize it as the body of earth is thrown over, and the cutters, from their peculiar inclined position, to disengage themselves from weeds and other obstacles as they pass the same, the several parts being precisely as described."

41. For an *Improved Method of Constructing Moulds for Making Printing Blocks;* James Berry, Roxbury, Massachusetts.

Claim.—"It is proposed to extend this invention to the production of cylinders as well as blocks, and also to set the types for the moulds by machinery, from which a great saving of labor will result; but this forms no part of my present invention; neither do I claim making blocks for printing by casting them into suitably prepared moulds; nor do I claim making blocks for printing woolen or other fabrics, by setting up movable types, and thus producing the requisite figures to be subsequently printed from; but what I do claim is, forming the moulds in which to cast printing blocks of types or prisms, in the manner described, and for the purpose set forth, by which I am enabled to produce a great variety of patterns at a very small cost, and in a comparatively short space of time."

42. For an *Improvement in Machines for Making Shovel Handles;* Russell D. Bartlett, Bangor, Maine.

Claim.—"I claim the combination and arrangement of the bed, the rotary holder, one or more vertical movable cutters, and one or more stationary cutters, as made to operate together and form the D or head part of the shovel handle, substantially as specified. And I claim the combination of the curved knife and the arc knife, so applied together as not only to allow them to be separated for the purpose of being ground, but to enable them to cut out the opening of the shovel handle, as specified. And I claim the combination applied to the shaft of the rotary holder and gear wheel, for the purpose of operating the holder, as specified, the said combination consisting of the cam blocks, the arm, the spring bolt, and the two studs, the whole being constructed and made to operate together, substantially as specified."

43. For an *Improvement in Seed Planters;* Charles W. Billings, South Deerfield, Mass.

Claim.—"What I claim is, linking, or otherwise equivalently attaching the pulverizing gauges to the draft bar in such a manner that the gauges are raised or lowered to regulate the depth of furrow to be cut, by elevating or depressing the draft bar to its proper pitch or height for the draft at a given depth of furrow, and whereby the draft bar and gauges are simultaneously raised or lowered, essentially as set forth. I also claim the combination and arrangement of the vibrating seed segment slides, geared together by

cogs or teeth on their peripheries, and operating in unison, as set forth. I likewise claim the manner of pivoting or jointing the vibrating segments at their centres of motion, by constructing the jointing pin with projecting ears or lips, and forming the joint hole of a key-hole shape, as described. I further claim, in combination with seed distributing slides, the employment of the double-acting spring clearing slides, arranged so as to be capable of lateral movement in either direction, and made self-adjusting to their original position, substantially as and for the purposes specified."

44. For an *Improvement in Faucets for Measuring Liquids;* Joshua Cross, New London, Ohio.

Claim.—"What I claim is, the construction and arrangement of a measuring vessel, and the valve of a faucet, substantially as described."

45. For *Movable Tapering Nozzles to the Exhaust Pipes of Locomotives;* Frederick Espenchade, Mifflintown, Pennsylvania.

"The nature of my invention consists in applying as many short movable pipes or nozzles, contracted to different sizes, as it is desirable to have variations of draft, which nozzles are severally brought over the discharge orifice of the exhaust pipes by any convenient means under the control of the engineer, whenever he may desire to vary the draft."

Claim.—"I am aware that various contrivances have been combined with the usual immovable conical nozzle of the waste steam pipe of locomotives for the purpose of enabling the engineer to vary the draft in the furnace, and therefore I limit my claim to the employment of movable tapering nozzles of various sized orifices, so arranged that either of the said nozzles may, at will, be brought over the mouth of the waste steam pipes, to vary the draft in the furnace of the locomotive, substantially as set forth."

46. For an *Improvement in Spring Clamps for Clothes Lines;* E. S. Haskins, Boston, Massachusetts.

Claim.—"I do not claim uniting the two parts of a clothes pin by a hinge, and closing the jaws by introducing a spiral or other spring between the opposite ends of the levers; but what I do claim is, the combination of the barrel, the groove, and the elastic band of india rubber, or other suitable substance, by which means the different parts of the clothes pin are held together securely, by the same spring which closes the jaws, instead of requiring a separate device for the purpose, as has heretofore been the case."

47. For an *Improvement in Machines for Dressing Stone;* Elbridge G. Hastings, Brooklyn, New York.

"The nature of my invention consists in the employment of a cylindrical cross-head, by which the ways or guides which carry and give direction to the motion of the tool stock are supported in front, and on which they turn freely, and of a tool stock to which the cutting tool is attached, having in its lower side a recess, corresponding more or less nearly to the curvature of the said cross-head, which said cross-head thus serves also as a rest or stop, at whatever angle the said ways or guides may be adjusted, and determines always the depth of the cut, and causes a perfectly true surface to be produced on the stone."

Claim.—"What I claim is, making the cross-head of cylindrical form, and the tool stock with a corresponding concavity, substantially as shown, so that the ways or guides which carry and give direction to the motion of the said tool stock, turn freely on the said cross-head, and the said cross-head serves as a rest or stop at whatever angle the said ways or guides may be adjusted, and thus always determines the depth of the cut, and causes a perfectly true surface to be produced on the stone."

48. For a *Process for Gilding or Plating Fibrous Substances;* Albert Hock, Rue de Grenelle, Paris, France; patented in France, Dec. 15, 1852.

"This invention consists in coating silk or other thread or yarn, tapes, or bands, with gold, silver, or other metal leaf, by first coating a cylinder or roller with the metal leaf intended to be used, and then winding thereon the silk or thread, or yarn, which is to be coated, after which metal leaf is to be laid on to the surfaces of the silk thread or yarn which has been wound on the cylinder or roller, when, by pressing the metal leaf with dry cotton, the silk or thread or yarn will be coated with the metal leaf."

Claim.—"What I claim is, the process, substantially as described, of coating silk (whether organzine, train, or twist,) and thread or yarn, (of silk waste and thread,) or yarn of cotton (or other fibres or mixtures thereof) with gold, silver, or other metal leaf."

49. For an *Improvement in Faucets for Measuring Liquids;* J. B. Lawrill and J. Cross, Bucyrus, Ohio.

"The nature of our invention consists in a simple and useful manner of constructing faucets, whereby they are made capable of measuring any given quantity, and of shutting off the supply from the cask, simultaneous with the discharge of the same from the faucet, and vice versa, when it is desired to measure another quantity, and susceptible of being speedily converted into a constant runner, when desirable."

Claim.—"What we claim is, the manner described of constructing faucets, whereby they are rendered capable of measuring any given quantity, and of shutting off the supply from the cask when it is desired to discharge the contents of the faucet, and of closing the discharge of the faucet when it is desired to measure a fresh quantity, and susceptible of being converted into a constant runner, when desirable."

50. For an *Improvement in Metallic Grummets for Sails;* Eldridge H. Penfield, Middletown, Connecticut.

Claim.—"I am aware that metallic grummets have been made with two parts, one being composed of a disk, or rim, and a cylindrical tube, and the other part of the disk or rim only; and also, that they have been made of two parts, where one of the parts was like the first, and the other part made similar, except that the tube was made with 'teeth or points,' as described in a patent issued to me, Sept. 19, 1848. I therefore do not claim either of these methods, as such, as my new invention; but what I claim is, the making of the metallic grummet of three or more pieces of metal, raised to the proper shape, when the several parts are constructed and arranged, substantially as described."

51. For an *Improved Stop Cock;* Orson C. Phelps, Boston, Massachusetts.

Claim.—"What I claim is, the flanch, in combination with the conical plug, constructed and operating as described, for the purpose set forth. 2d, I claim the air cushion within the plug, constructed and arranged in the manner and for the purpose substantially as described."

52. For an *Improved Faucet;* Ezra Ripley, Troy, N. Y.

"The nature of my invention consists in adjustable clamps or jaws, combined with a faucet tube, for the purpose of opening and closing, at pleasure, the discharge orifice on one side of the tube."

Claim.—"What I claim is, the adjustable clamps or jaws, in combination with the faucet tube, for the purpose of closing and opening the discharge orifice when drafting or drawing fluids, constructed and operating substantially in the manner and for the purpose as described."

53. For an *Improvement in Rotary Engines;* Gerard Sickels, Brooklyn, New York.

"This invention relates to a method of making and maintaining a perfectly tight fit between the cylinder and the revolving head which carries the pistons or sliders, without the aid of packing; and is applicable to rotary engines, with variously constructed and arranged pistons. It consists in making the revolving head with a flanch on one side only, which flanch has its inner face fitting to a suitable surface within the cylinder, while that face of the main portion or hub of the head opposite the flanch, fits close to the bottom end of the cylinder, and admitting steam to act on the sides of the revolving head, thereby packing up the head to the cylinder."

Claim.—"I do not confine myself to the particular construction, arrangement, or manner of operating the pistons, as described, nor to the form of the working faces of the revolving head and cylinder; but what I claim is, the method described, of making and maintaining a perfectly tight fit between the ends of the cylinder and the revolving head which carries the sliders or pistons, by admitting a pressure of steam outside of the flanch of the revolving head, substantially as set forth."

54. For an *Improvement in Machines for Grinding Cotton Cards;* Nathaniel Smith and Asa Crandall, North Kingston, Rhode Island.

"The nature of our invention consists in the employment of a narrow emery roller, made to traverse back and forth on a horizontal right and left or endless screw, from one end of the card cylinder to the other, and simultaneous therewith to describe vertical circles, and thereby caused to operate in a parallel line with the carding cylinder upon the whole face of the card, and gradually and effectually grind the teeth of the same to a perfect uniformity in length, and give them the proper finish."

Claim.—"What we claim is, a narrow emery card grinder, carrying a weighted forked lever or shifter, and keyed loosely on an endless or right and left screw, which, in combination with the forked lever or shifter, gives a continuous back and forward traverse to said grinder, and serves also as a shaft for it to hang and move upon while grinding the cards, the whole being constructed, arranged and operating essentially as and for the purpose described."

55. For an *Improvement in Seed Planters;* Welcome Sprague, Ellicotsville, N. Y.

"The nature of my invention consists in so constructing this seeding machine, that the several operations of making the dibble or receptacle in the soil, conveying the seed from the hopper or reservoir, delivering the same therefrom, and with certainty ensuring its conveyance and deposit in the earth, shall all be effected by the most simple and economical arrangement of mechanism, and that without a single cog or gear, by the mere rolling over of the wheel on the earth, as in a common drill barrow."

Claim.—"What I claim is, the combination of the hollow hub or grain reservoir with the tubes, piston, and rods, operated by the cam grooves, or its equivalent, on the diaphragm, the whole arranged in the manner substantially as set forth, for the purpose of insuring the deposit of the seed in the soil."

56. For *Hanging of the Griping Jaw of Spike Machines in Weighted Levers;* James H. Swett, Pittsburgh, Pa.

Claim.—"What I claim is, the so hanging of the griping jaw in weighted levers, or their equivalent, as that when two spikes, or a spike and a blank, comes in between the griping jaws at one time, the said jaw may rise and yield to the excess of metal between the dies, and prevent the breaking of any of the parts, substantially as described."

57. For *Improvements in Rotary Cultivators;* Philander Shaw, Abington, Mass.

Claim.—"What I claim is, the method of hanging and operating the spades, they being applied in one or more vibrating sets to a rotary frame, each spade being hinged to the frame and made to turn through the sector of a circle, and provided with stops and a stud to act against a stationary cam, as described; the whole being applied together, and to a carriage or frame, and made to operate so as not only to dig into and raise earth, but to perform the office of impelling along on the ground the whole machine, substantially as specified."

58. For an *Improvement in Steam Engine Faucet Valves;* Abijah Taylor, Pekin, Ill.

Claim.—"What I claim is, my peculiar valve, constructed, adapted, and arranged in such manner as to perform the functions of a safety and pressure valve, as described."

59. For *Improvements in Folding Blinds;* Mansel Blake, Assignor to himself, James B. McAlestee, and Erastus Blake, Sutton, New Hampshire.

Claim.—"What I claim is, the arranging a series of slats on one set of the parallel bars of a folding frame of parallel and crossed bars, so that the slats shall not only extend from end to end of their several bars, but be made to overlap one another, and thereby, in connexion with the folding frame, form a folding blind or shutter, made to operate as specified."

60. For an *Improvement in Obstetrical Supporters;* Westel S. Daniels, Panama, N. Y.

Claim.—"What I claim is, extending the thigh straps across the top of the knees, and arranging them to run through rings, or their equivalents, where they are connected with the knee and feet straps, so that they may be seized by the hands of the user, and drawn up to increase, or slackened to graduate, the pressure of the back pad against the back, as desired, without changing the position of the body, legs, or feet, substantially as described."

61. For an *Improvement in Smut Machines;* Lewis Fagin, Cincinnati, Ohio.

"The nature of my invention consists in a vertical machine, combining on one shaft a smut and scouring apparatus, capable of ejecting the smut, chaff, &c., from wheat before scouring it for flouring purposes, and also of retaining the scattered grains, and returning the same into the scouring department again, and thoroughly scouring the whole with the least liability to break the wheat, so that it becomes pearled to a considerable extent before it finally passes out at the place of delivery."

Claim.—"What I claim is, my method, or its substantial equivalent, of arranging a blowing apparatus, where the upper or suction fan takes the air at the centre, and discharges on the periphery, to precede, on the same shaft, a scouring mill, for the purpose of taking from grain the smut, chaff, &c., before the scouring process is commenced, and

afterwards thoroughly scour the same, thus constituting the cleansing and scouring processes the duty of a single machine, substantially in the manner and for the purpose described. I also claim the cylinder, hopper, and feed pipe, as arranged, or their equivalents, and for the purpose described. I also claim the collar, as arranged, and for the purpose described. I also claim the guide, as arranged, and for the purpose described. I also claim the scouring cones, severally and collectively, with their circular and horizontal grooves and perforated terraces, or their equivalent, and in combination with the conical fan and beater, substantially as described, and for the purposes enumerated."

62. For an *Improvement in Securing Window Sashes;* Alpheus Kimball, Fitchburgh, Massachusetts.

Claim.—"I do not claim confining window strips or beads, by letting them into mortises in the top and bottom of the frame, as this has been done before; but what I do claim is, confining window sashes by means of strips which are raised into deep mortises in the top of the frame a sufficient distance to enable them to be dropped into shallow mortises at the bottom of the frame, the strips being held against the sashes by the pressure of a screw, or other analogous device, in the manner described. 2d, The method of securing and tightening the sashes by means of pressure upon the exterior of the sash strip, whether it be produced by screw, in the manner described, or by any other analogous device."

63. For an *Improvement in Grain Harvesters;* Dan. S. Middlekauff, Hagerstown, Md.

"The nature of my invention consists in constructing a machine for the purpose of cutting grain, and leaving it in gavels or sheaves suitable for binding."

Claim.—"What I claim is, 1st, The rotary knives or cutters, the edges of which pass by each other for the purpose of forming a continuous edge for the purpose of cutting the grain. 2d, The reels and the spring catch and projection on the wheels, in combination with the apron, for the purpose of supporting the grain in an inclined position, in the manner and for the purpose described."

64. For an *Improvement in Machines for Drilling Stone;* Simon Pettes, City of N. Y.

"The nature of my invention consists in constructing one for drilling rock, &c., of an exceedingly portable character, and by the arrangement of the operative parts, giving certainty of action in the turning of the drill head, thus obviating the liability to jamb or deface the lifter, while, at the same time, the diagonal rib on the face of the lifter serves the purpose of a greater throw than one placed radially from the shaft on which the lifter turns."

Claim.—"What I claim is, so placing on the sliding frame the windlass with ratchet, whose pawl is acted on by the drill head at each descent thereof, and thus feeds the entire mechanism as the work proceeds, substantially as set forth."

65. For an *Improvement in Processes for Making Varnishes;* Jonathan Burrage, Roxbury, Assignor to J. Burrage and F. W. Newton, Newton, Massachusetts.

Claim.—"I am aware that the exudations from the pinus canadensis and pinus picea, (which exudations are respectively known in commerce by the names of 'Canada balsam' and 'Venice turpentine,') have been mixed with essential oil, or spirits of turpentine, in the manufacture of varnishes; I therefore do not claim such mixtures as forming any part of my invention; nor do I claim the employment of sulphate of zinc, litharge, or magnesia, in an oil for the purpose of imparting drying qualities thereto; nor do I claim, in making a varnish, the employment of a virgin turpentine, or that which is in the natural and liquid state it has when it exudes from the tree, but as, by exposure of the crude or natural liquid turpentine of the 'pinus abies,' or 'pinus silvestris,' to the action of air and light for several weeks or months, it becomes hard and brittle and decolorized, and otherwise changed, or has its essential oil evaporated, and is otherwise purified of much that is objectionable in varnish, and, in fact, becomes another, or highly improved article for the manufacture of varnish, and as such has never, to my knowledge, been used in making varnish, but only in the composition of plasters, or for other purposes in medicine, and in calico printing, and some other arts, it being known in commerce by the names of 'gum thust' or 'gum sass.' I claim as my invention, the above described process or mode of making varnish, viz: by combining gum thust or gum sass with the essential oil of turpentine, and treating the mixture substantially as specified."

66. For an *Improvement in Seed Planters;* J. G. Macfarlane, Perry County, Penna.

"My invention consists in the employment of a self-acting slide or scraper, working over the feeding apertures for preventing more than the proper number of grains from

falling to the furrow at each hill; also, in the use of a hanging scraper, by which the groove of the wheel is always kept clean, so as to be in condition for facilitating the operation of the wheel."

Claim.—"What I claim is, the combination of the action of the levers, cams, spring, and the weight of the scraper to clean the wheel."

MARCH 21.

67. For an *Improved Machine for Distributing Type;* Victor Beaumont, City of N. Y.

Claim.—"What I claim is, 1st, The combination, called distributing channel of the channel sides, lever, and slide, with two springs, lever, and rod, or their equivalents, substantially as described. 2d, The combination of distributing and receiving channels with disk, ring, and eccentric shaft, or their equivalents, by which the distributing and receiving channels are brought into contact along a curve, the last element of which curve is perpendicular to their faces of contact, substantially as described."

68. For an *Improvement in Grain and Grass Harvesters;* Henry Green, Ottawa, Ill.; ante-dated September 21, 1853.

"The nature of my improvements consists in arranging the sickle bar so as to operate a proper distance in advance of the sickle stock, and traversing it in blocks fastened to said stock, making a space in the rear of the sickle teeth, which are extended back behind the bar, and sharpened so as to cut off any grass, stalks, &c., which may collect between the sickle bar and stock. Also, in constructing the carriage and connecting the sickle stock to it in such a way and manner that the stock travels parallel with the ground, accommodating itself to the undulations of the surface, while the rear end of the carriage travels so high as to clear the grass, grain, etc., cut at a previous swath."

Claim.—"What I claim is, 1st, The V-shaped space or zigzag shape of the rear of the sickle teeth, or the equivalent thereof, the angles of which press the substances back which collect upon the fingers and prevent them from clogging the sickle. 2d, Extending the rear ends of the sickle teeth back behind the sickle bar, whether made as represented in the drawing, or broader, or extended back to a point. Also, sharpening said rear ends so as to cut off any stalks, grass, etc., which may collect upon the fingers between the sickle and the stock. 3d, Terminating the sickle stock at the inside of the rail, and fastening them together, substantially as described, thereby permitting the sickle and stock to travel near the ground, and parallel with it, while the rear end of the carriage is carried so high as to clear the grass or grain cut at the previous swath."

69. For an *Improvement in Compounds for Extinguishing Fires;* Ralph Bulkley, City of New York.

"The nature of my invention consists in providing a ship or a building with an aperture, which aperture is to be used when the ship or building is internally on fire, for inserting a composition of matter that will burn under any circumstances, and produce a predominant smoke, so vapid in its nature as to extract the oxygen from common air, vapor, or steam, and render every æriform therein inert, and quickly thereby extinguish flame, embers, and coals of fires, in any part, apartment, or apartments thereof."

Claim.—"I am aware that a patent has been obtained for a composition of sulphur and nitre for producing 'sulphurous acid gas' for extinguishing flame; but I contend that the composition of vegetable and mineral matter described, for producing a vapid smoke, comprises a patentable difference from all other improvements therefor. What I claim is, the application to ships and buildings of a composition of fossil and vegetable substances which will transmute, by the action of fire in close places, and produce a predominant smoke that will extinguish common fire, as described, using for that purpose the aforesaid compound, or any other substantially the same, and which will produce the intended effect."

70. For an *Improvement in Machines for Rubbing Type;* Daniel Moore, City of New York, Assignor to George S. Cameron, Charleston, South Carolina.

"The nature of my invention consists in the use of a supply plate, from which the type are thrown by centrifugal force through a gutter or trough, on to a conducting plate, that by an elastic roller supplies the type to a series of rotary fingers that carry the type, first, over a stone or similar rough surface, that takes off any small burs or feather edges that in getting into the cutters might cause the type to deviate from its course; next, the type is carried through between a series of two or more cutters that successively remove the sides of the type, and the burs thereon, the type passing finally between brushes which

clean or remove from the type the fibres or shavings of metal that have been cut from the type, and leave it ready for use."

Claim.—"What I claim is, 1st, The centrifugal supply plate, combined with the conducting plate by means of the channel, or its equivalent, to pass the type as specified. 2d, The elastic roller, moved by the pinion and spur wheel, to separate the types, as specified. 3d, The stones, or similar cutting surface, to operate first on the type, as described. 4th, The use of two or more pairs of cutters, the lower ones being connected by the bridges to remove the projections and rub the type, as specified. 5th, The brushes to clear the type prior to delivery from the machine, in the manner specified. 6th, The means shown, consisting of the ring and screw nut, for changing a whole set of the fingers, according to the thickness of type to be rubbed, as specified."

71. For *Improvements in Safe Locks;* F. C. Goffin, City of New York, Assignor to A. B. Ely, Boston, Massachusetts.

Claim.—"What I claim is, the arrangement of the sectors in such manner that a part of the number shall have the portions above the slots of a radius greater than the rest, so as to project beyond the other sectors, and with smooth peripheries, substantially in the manner and for the purpose set forth. The arrangement of slot holder and notch holder, with the se.tors, by which, while the former engages with all the sectors, the latter engages with those only that have not a smooth periphery, substantially as described. The arrangement of the slot holder, or slot and notch holders and their catches, with the slotted, or slotted and notched sectors, in relation to the key hole, substantially as described."

72. For an *Improvement in Iron Safes;* Obadiah Marland, Boston, Massachusetts.

Claim.—"I do not claim the lining of safes with soap stone, independent of the means of attaching it to the outer plate or shell, and of protecting it from breaking, as this has been done before; but what I do claim is, the combination of a lining of soap stone, or other suitable material, with the internal protecting plate on the inner surface of the door, when the said lining is constructed in the manner described, so as to dispense with any metallic connexion between the outer metallic casing and the internal surface of the door, whereby I am enabled to avoid the heat of conduction passing from the outer to the inner surface of the safe, as set forth."

73. For an *Improved Machine for Dressing Spokes;* R. P. Benton, Rochester, N. Y.

Claim.—"Having obtained a mode of making a constantly varying cross section in the shape of a spoke with a single pair of cutters, in which is given a rotary, a lateral, and an oscillating motion; what I claim is, the arrangement producing these different movements, as described, viz: the shafts, frame, carriage with its grooves, elbow lever, and bolt, or their equivalents."

74. For an *Improvement in Lifting Jacks;* Jermy W. Bliss, Hartford, Connecticut.

Claim.—"What I claim is, the combination of the toothed cams, with the lifting frame or slide, arranged and operating together as and for the purposes set forth, when the said cams are so constructed at their finishing extremities as to form a bearing surface on either side of the centres of the axes of the cams, whereby the jack is made self-setting, and is restrained from flying from its set, as specified."

75. For an *Improvement in Processes for Dyeing;* Chas. T. Appleton, Roxbury, Mass.

Claim.—"I do not intend to limit myself to any particular machinery for the purpose of producing the reciprocating motion of the cloth, as this forms no part of my invention, and a great variety of machinery may be employed for the purpose, which may be actuated either by hand or other power. And I do not intend running the cloth through the machine from end to end, and back and forth, as has heretofore been practised in machine and hand dyeing; but what I do claim is, communicating to the goods while in the vat, a reciprocating motion back and forth, of at least double the distance from the upper rollers to the surface of the liquor, so as to insure the immersion of the whole material once for each vibration, by which means I am enabled to give the whole of the fabric any required number of dips, and to interrupt the operation at the instant the desired shade is attained, as set forth."

76. For an *Improved Hydraulic Engine;* Augustus C. Carey and Jeremiah Smith, Ipswich, Massachusetts.

"The nature of our invention consists in having two horizontal trunks, water chambers,

or cylinders, provided each with a valve and piston. The pistons have adjustable or movable heads, and the ends of the piston rods are secured to connecting rods or levers, which are attached to reverse cranks on a shaft, having a gear wheel upon it, from which gear wheel the power is taken. The water from the flume is made to act by means of the valves in the trunks, chambers, or cylinders, first against one piston, and then against the other, and a continuous rotary motion is given the crank shaft. The water in the trunks, chambers, or cylinders, after acting against the pistons the length of the stroke, is let out by the operation of the movable heads."

Claim.—"We are aware that hydraulic engines have been previously used, but differently constructed from ours; we do not claim pistons attached to a crank shaft, and working by the force of the water alternately in trunks or cylinders, for the purpose of applying water power to the propelling of machinery; but what we claim is, the peculiar arrangement of the valves and piston heads, as described, viz: the piston heads being movable or hung upon centres, and opened and closed by means of rods acted upon by pins or studs at each end of the strokes of the pistons, the valves being opened and closed alternately, by means of the pins on the crank shaft acting against the arms, by which arrangement the water is permitted to act, not only alternately upon the pistons, but also allowed to escape from the trunk or cylinders when the water has forced them along within the trunks or cylinders, the required distance or length of stroke."

77. For an *Improvement in Screw Wrenches;* Dexter H. Chamberlain, Boston, Mass.

Claim.—"What I claim is, making the wrench with a split or double shank, a movable jaw to embrace and slide on the shank, and a tapering screw, or its equivalent, applied to the shank, so as to be capable of separating the two parts of the shank, and thereby clamping the movable jaw in place on the shank, all substantially as specified."

78. For an *Improvement in Concaves of Clover Hullers;* Thomas Carpenter, Manlius, New York.

"The nature of my invention consists in substituting cards, such as are used in carding wool, &c., in place of the teeth and other devices in common use for the same purpose, and which latter are objectionable in breaking the seed."

Claim.—"What I claim is, the manner set forth, of threshing or clearing the hull from the berry of clover seed, viz: by passing the seed between two cards, as described, one of the cards being attached to the surface of a cylinder, and the other attached to a concave surface, so that the wires of the cards are in contact, the cylinder being revolved, while the concave is stationary, the hulls are rubbed off without danger of cracking the seed; the whole constructed substantially as described."

79. For an *Improvement in Dredging Machines;* Charles H. Fondé and Thomas B. Lyons, Mobile, Alabama.

Claim.—"We do not claim the wheel with the buckets or scuppers across its periphery; nor do we claim the means of revolving said wheel, or the means of elevating or depressing the same, with the view of increasing or diminishing the depth of earth caught by the scuppers; but what we do claim is, a tilting tipper applied to a dredging wheel, said tipper dropping within the outer circumference of said wheel, so as to be in a position to receive the mud discharged from the buckets, as set forth. Also, the arrangement for causing the tipper to tilt out of the way for the full buckets to pass and return again to its position to receive the mud discharged, and for keeping the tipper in gear with the wheel, so that it will always perform its duties, notwithstanding the difference in their relative positions when raising and lowering the wheel. We further claim the combination of the latch or dog with the ledge of the bed plate of the bucket, by means of which the bucket is adjusted and held firm while digging and raising the earth, as set forth."

80. For an *Improvement in Grain Threshers;* J. L. Garlington, Snapping Shoals, Ga.

"The nature of my invention consists in threshing grain in a more perfect manner than has ever been done before, by the employment of a vertical revolving, adjustable springing disk, having a series of beaters, set tangentially to its axis, around its face, and another series placed radially round its periphery, in combination with a stationary concave, having a series of stationary strippers, arranged tangentially on the inner face of one of its sides, directly under the passage where the grain is fed in, and another series of strippers, placed radially, for a short distance round its inner periphery."

Claim.—"What I claim is, the employment of a vertical adjustable and springing disk, made elastic by means of a spring bearing against the end of its shaft, and adjustable by set screws, which pass through the ends of the spring, and throw it into action to a

greater or less extent, according as they are turned, and having a series of beaters set tangentially to its axis around its face, and another series placed radially round its periphery, in combination with a stationary concave, having a series of stationary strippers, arranged tangentially to the axis of the revolving disk on the inner face of one of its sides directly under the passage where the grain is fed in, and another series of stationary strippers placed radially for a short distance round its inner periphery, the whole being constructed, arranged, and operating in the manner set forth, for the purpose of effecting the objects specified in the foregoing description."

81. For an *Improvement in Nippers for Printing Presses;* Charles W. Hawkes, Boston, Mass.

Claim.—"What I claim is, the device for removing the sheet from the form after the impression has been given, substantially as set forth. 2d, I claim the nipper frame, constructed in the manner as described, and for the purpose specified."

82. For an *Improvement in Harvesters;* Philip H. Kells, Hudson, N. H.

"This invention consists in so placing the knife frame that the bar to which the cutting blade is attached shall be in a range with, and perpendicular to, the side of the guiding roller, when the axis of that roller is parallel to the axis of the driving wheel."

Claim.—"What I claim is, laying the bar which carries the cutting teeth ranging with the guide roller, and perpendicular to its side face, when the axis of said roller is parallel to the axis of the driving wheel, for causing the cutter bar to conform to the surface of the ground passed over, and for the prevention of accidents to the cutting teeth, as set forth, said bar being on the gearing side of the machine."

83. For an *Improvement in Railroad Car Wheels;* Jordan L. Mott, City of N. York.

Claim.—"I do not claim the making of hollow railroad wheels, that is, wheels with two plates connecting the hub and rim; nor making wheels with separate hubs for the two plates; but what I do claim is, making railroad wheels with the outer face of any of the usual forms, in combination with the inner plate, of a conical or nearly conical form, connected with the axle towards the middle of its length, to brace the rim of the wheel to resist lateral thrusts, and greatly reducing the liability, if not entirely avoiding the breaking or bending of the axle, all substantially as specified."

84. For an *Improvement in Self-Fastening Shutter Hinges;* Ambrose Nicholson, Poland, N. Y.

Claim.—"I do not claim locking the shutter by its up and down motion, that being a common device; but what I do claim is, the eccentric extension and recess of the plate, in combination with the pin of the plate, by which, in connexion with the elongated eye and cylindrical pin, I am enabled to move the shutter and catch it or release it, without giving it any upward or downward motion, as set forth."

85. For an *Improvement in Machines for Dressing Mill Stones;* J. G. Shands, St. Louis, Missouri.

Claim.—"What I claim is, placing the wiper wheel which operates the arbor and pick, on a swinging frame, as described, by which a greater or less length of vibration may be given the arbor, and the pick be made to act with a corresponding degree of force upon the stone."

86. For an *Improvement in Devices for Preserving Hen's Eggs in the Nest;* C. V. Ament, Dansville, New York.

Claim.—"What I claim is, constructing a hen's nest with two peculiarly constructed and arranged chambers, which communicate with each other through a hole in the centre of the nest, and self-adjusting false bottom under the same, the upper chamber being provided with a suitable nest, and a number of false eggs for the hen to set upon, and the lower one is provided with a soft cushioned surface for the eggs to fall upon, which is made of such shape that the real eggs, as they escape through the false bottom, are caused to roll gradually towards the edge of the bottom, and remain there until removed, the whole being constructed and arranged in the manner and for the purposes described."

87. For an *Improvement in Anti-Friction Boxes;* David A. Morris, Pittsburgh, Pa.

Claim.—"I do not claim the employment, for the purpose of causing the rollers to revolve simultaneously and uniformly, of spur gear teeth on axle, several friction rollers,

and interior of the box, as that is covered by the claim of Joseph Harris, Jr., of Feb. 28, 1848; but what I claim is, furnishing the series of anti-friction rollers at one or both ends, or at any part of their length, with a series of toothed wheels, one for each, and an endless chain, substantially as and for the purpose described."

88. For an *Improvement in Dyeing Apparatus;* Charles T. Appleton, Roxbury, Mass.; patented in England, Jan. 7th, 1854.

"My invention consists in passing the material to be dyed over the surface of a perforated cylinder or tube, the dyeing liquor being forced into the tube, and out at the perforations in the same, through the body of the cloth, which is passed through the machine from one roller to another, and is made to press tightly upon the surface of the cylinder, fine streams of dyeing liquor from the perforations passing through it in such quantities as may be requisite, and displacing and forcing out the globules of air with which the pores of the goods may be filled."

Claim.—" What I claim is, the described machine or apparatus for the purpose of dyeing, to wit: the combination of the perforated cylinder, constructed as described, with the force pump, or its equivalent, operating in the manner substantially as set forth."

89. For an *Improvement in Belt-Saws;* David A. Cameron, Butler, Pa.

Claim.—"What I claim is, 1st, The application of the lever and movable frame to tighten the saw, and to keep it always uniformly tight, in the manner set forth. 2d, The sliding collar on the cylinder, or drum, with adjusting screws, by which the saw is brought forward, and made to project beyond the edge of the drum; and, 3d, The conical pins placed in the drum, when constructed and used in the manner and for the purposes set forth."

90. For an *Improvement in Shoe Lasts;* Thomas Dougherty, Erie, Pa.

Claim.—"I do not claim the mere construction of a last of wood and metal; but what I do claim is, the construction of a last consisting of a metallic shell or casing, inclosing wood placed endwise upon the sole, and having soft metal pieces upon the sides of the last, for the purposes set forth."

91. For an *Improvement in Machinery for Making Barrels;* George W. Livermore, Cambridgeport, Massachusetts.

Claim.—"What I claim is, 1st, Forming or shaping the staves previous to jointing them, by passing them through a series of pairs of curved rollers, in the manner set forth. 2d, The peculiar construction of the carriage of the jointing machine, the bar being made adjustable within the long slots or mortises, in the manner set forth. 3d, The combination of the cone with the spring drivers, operating as described, for the purpose of guiding the hoop to the barrel, and driving it into place, in the manner set forth."

92. For an *Improvement in Portable Metal Punches;* Samuel McKenna, Cincinnati, Ohio.

Claim.—"I do not claim the invention of the punches, the dies, or lever and eccentric, as a means of applying pressure; but what I claim is, the arrangement, for a portable punch, of the tongue, connected jaws, stirrups, punches, dies, lever, and eccentric, as described."

93. For an *Improvement in Seed Planters;* David Wolf and Herman Wolf, Lebanon, Pennsylvania.

Claim.—"What we claim is, the combination of annular revolving perforated plates, with curved grooves on the underside thereof, constructed substantially in the manner and for the purposes described."

94. For an *Improvement in Machines for Jointing Staves;* Alexander Wilbur, Lancaster, Pennsylvania.

"The nature of my invention relates to the method of jointing staves of variable widths, each with its requisite bilge, without adjusting the machine, it having a self-operating adjustment for each and every width. Also, in combination with the swing frame, in which the stave is presented to the cutter wheel, the guides which move with it, for the purpose of holding the edge of the stave being dressed firmly to the wheel of cutters."

Claim.—" What I claim is, so hanging the swing frame which feeds up the stave to the jointing wheel, as that staves of variable widths may be dressed with the bilge necessary for said widths, substantially as described. Also, in combination with the swing frame,

the guides which move with it, for the purpose of firmly holding the stave to the jointing wheel or cutters, substantially as described."

95. For an *Improvement in Crozing Machines;* Alexander Wilbur, Lancaster, Pa.

Claim.—"What I claim is, so combining the crozing tool with the cutter head, as that said crozing tool may be thrown into or out of operation, whilst the cutter head continues its rotation, by means of the centre pin, or its equivalent, substantially as described."

96. For an *Improvement in Quartz Crushers;* Herman Gardiner, City of New York; patented in England, July 5th, 1853.

"The nature of my invention consists in making and using an oblong chilled cast iron trough, arranged in a suitable frame, and having on the side rails of the trough frame reversed inclined planes, so as to give a winding rolling motion to a heavy cast iron ball in the trough, as it is made to roll backwards and forwards by means of a connecting rod attached to a crank, and driven by any suitable power, for the purpose of making a machine for crushing and pulverizing earths, quartz rock, or other substance containing any of the precious or baser metals."

Claim.—"What I claim is, the crusher trough, having on each side rail reversed inclined planes, for the purpose of giving the ball, as it is propelled backwards and forwards in the trough, a twisting motion, substantially as set forth."

97. For a *Rotary Smoothing Iron;* Jeremiah W. Brown, Hartford, Connecticut, Assignor to Samuel M. Folsom, Charlestown, Massachusetts.

"The nature of my invention consists in the peculiar form and make of the same. The body or smoothing part of the iron I make with two or more faces, to revolve on an axis at each end passing through the stems of the handle, so that when the lower face, which is in use, becomes cooled in operation, and requires heating up again, I can, by merely taking out a pin, or some other equivalent, turn the upper part down to take the place of the lower face when cooled in working."

Claim.—"What I claim is, the revolving smoothing iron, heated by means of a spirit or gas lamp internally, or its equivalent, in the manner and for the purpose substantially as described."

MARCH 28.

98. For an *Improvement in Machines for Jointing Staves;* E. Valentine and A. Bradway, Monson, Massachusetts,

Claim.—"What we claim is, the combination of the alternate reversely curved ledges on opposite sides of the double curved channel, with the springs, and placed opposite to their concave portions, for the purpose of directing the staves alternately to the jointers, arranged along said concave portions of the ledges, with a properly curved motion for jointing both edges of the staves to a suitable form, substantially as set forth. We also claim the uniformly flexible metallic strips at the sides of the recess, just in front of the cutters, in combination with the adjusting lever, for the purpose of enabling the curvature of the stave to be varied by tightening the said metallic strips, and thus varying the curved sides of the recess, substantially as set forth."

99. For an *Improvement in Ship's Blocks;* Elbridge Webber, Gardiner, Maine.

Claim.—"What I claim is, the shell of cast or wrought metal, into which are fitted the wooden cheeks and the shieves, the whole constructed and arranged as described."

100. For an *Improvement in Presses for Treating India Rubber;* Ellsworth D. S. Goodyear, Stapleton, N. Y., Assignor to the New York Rubber Co., City of N. Y.

Claim.—"I am aware that water has been forced into the interior of hollow articles of plastic material, by mechanical means, for the purpose of forcing the material against the interior of moulds; but such mode of using a fluid I do not claim; but what I do claim is, the introduction of water, or any other liquid, into the interior of articles which require expansive force for their perfect formation to the interior surface of moulds, said liquid to be converted into steam, substantially as described."

101. For an *Improvement in Churns;* Robt. H. Harrison, Assignor to R. H. Harrison and John S. Gallaher, Jr., Washington, D. C.

Claim.—"What I claim is, 1st, The construction of a churn vessel, with hollow or solid double concave adjustable detachable side gatherers, specifically as shown. 2d, The

construction of a churn reservoir dasher, having curved or deflective radial chambers of a concavo-convex form, with direct radial wings or flanches, and the using the same, combined with the double concave gatherers. 3d, Also, the double application of warm and cold water, or ice, in combination with the dasher and the double concave gatherers, substantially as set forth. I do not, however, claim the application of hot or cold water solely in the process of butter making, as the same have been employed separately or distinctly heretofore, as is well known."

102. For an *Improvement in the Discharging Apparatus of Harvesters;* A. J. Cook, Enon, Ohio.

Claim.—"What I claim is, the device for forcing the unbound grain from the table, in combination with the arm at the end of the reel and the apron, by means whereof the grain is carried from the platform to the receiving table, and thence deposited upon the stubble, in convenient quantities for binding."

103. For an *Improvement in Belt Clasps for Machinery;* H. G. Ellsworth, Auburn, New York.

"The nature of my invention, with a view to avoid the defects enumerated, consists in splicing or uniting the ends of belts, end to end, by means of metal plates riveted or otherwise secured to the outer surface of and near the ends of the belt, which plates are made to clasp and interlock, to form the connexion and keep the inner face of the belt smooth and even, and free to bend around pulleys and drums, and be held together entirely by the union of the two part clasp, whilst the inner face of the belt which passes in contact with the pulleys or drums shall present a perfectly smooth and even surface."

Claim.—"What I claim is, the method of uniting or splicing belts end to end, by means of metal plates riveted or otherwise secured to the outer surface of, and near the ends of the belt, and clasping or interlocking, in manner substantially as described."

104. For an *Improvement in Harvesters of Grain;* Benjamin G. Fitzhugh, Frederick, Maryland.

Claim.—"I make no claim to the movable blade, in itself, as such a blade has heretofore been used. What I claim is, 1st, The movable blade in the fingers, arranged and secured in place, in the manner and for the purposes set forth. 2d, The combination of a curved reciprocating knife with a curved row of fingers and a curved platform, as described. 3d, Constructing the reel with curved beaters, substantially in the manner and for the purpose set forth. 4th, The combination of a continuously revolving sweep rake with a revolving reel, which disposes the grain upon the platform, with its stalks converging to the axis of the rake, substantially as set forth."

105. For an *Improvement in Seed Planters;* Luther B. Fisher, Coldwater, Michigan.

Claim.—"I do not claim the form of the frame, or the method of operating the slides; but what I do claim is, the combination of the rod, lever, clevis, and pin, when the latter is movable in a longitudinal slot for raising the teeth from the ground, as set forth. Also, the attachment of the rods operating the slides to the hook, as described, so that the slides will remain at rest during the turning of the implement."

106. For an *Improvement in Feed Water Apparatus for Steam Boilers;* Benaiah Fitts, Worcester, Massachusetts.

Claim.—"What I claim is, the arrangement of the steam and water chambers, chains, pipes, and valves, constructed and operated and for the purposes set forth."

107. For an *Improvement in Making Zinc White;* Richard Jones, County of Burlington, New Jersey.

Claim.—"What I claim is, the method described, of cooling, conveying, and oxydizing the vapor of zinc by means of a jet of air introduced into a closed retort, substantially as described. I likewise claim constructing the conduit pipes so that every portion of them shall be inclined in such manner as to prevent the accumulation of matter to clog them, and to direct the current of vapor downwards on entering the condensing chambers, the conduits thus constructed and operating being arranged over the collecting or condensing chambers, substantially as described."

108. For an *Improvement in SmutMachines;* Seymour Ketchum, Lancaster, Ohio.

Claim.—"I do not claim, of itself, building the concave of staves with vertical openings between or in them, for the dust, &c., to pass through; but I do claim the concave con-

structed as described, viz: of loose staves so fitted to or connected with the heads of the concave as to be capable of circular adjustment with facility and despatch, for the purpose of varying the number and widths of the escape openings between the staves, the said staves being formed on their inner face with a longitudinal step or steps inclining outwards backwardly, in relation to the travel of the runner, whereby the width of the openings between the staves may be made large, so as to form a ready escape for the smut, dust, and other extraneous matter, without letting out the grain or wheat therethrough, and whereby the clogging of the escape openings by damp smut is avoided, essentially as set forth."

109. For *Portable Head Rests for Chairs;* C. P. Bailey, Zanesville, Ohio.

Claim.—"What I claim is, the apparatus described, consisting of a back plate with arms for supporting the band or cushion upon which the head rests, the whole being sustained by the hips which hold it in place at all times, disconnected with the back of the seat, but resting against or upon it, so as to be at once taken away without injury to the seat, and folded up in portable form, the whole being constructed and arranged substantially in the manner described."

110. For an *Improvement in Submarine Scoops;* Anson Balding, Olney, Illinois.

Claim.—"What I claim is, the combination of the scoop and sled, for the purposes described."

111. For an *Improvement in Hot Air Furnaces;* Thomas W. Chatfield, Utica, N. Y.

Claim.—"What I claim is, the radiators, constructed as described, and for the purposes described, the whole being arranged and combined substantially in the manner set forth. I am aware of the patents of Gordon Fox, patented in 1843, and of G. Walker, patented in 1844; I do not claim anything contained in either of these patents, but only those points and contrivances wherein I have improved upon both of these patents, as set forth."

112. For an *Improvement in Machinery for Operating Car Brakes;* Joseph Marks, Dunkirk, N. Y., Assignor to Wm. Whitney, Roxbury, Massachusetts; patented in England, November 23, 1852.

Claim.—"I do not claim any mode of of forcing the brakes of one or more cars against their respective wheels by any mechanism brought into action by a power generated on an axle of the engine; but what I do claim is, 1st, the adjustable spring clip or clips, in combination with the pawl lever or levers, and the draft rope thereof, and as applied and made to operate substantially in the manner specified. 2d, In combination with the cord extending from the locomotive to the brake shaft and the pulley, I claim the traveling nut, screw, stud, and pin, in the manner and for the purpose substantially as specified. 3d, The combination of the lines and the mechanism for operating the same, as described, whereby the several brake springs of a train of cars may be wound up simultaneously, or one or more of them at a time, as required, in combination with the line and the mechanism for operating the same, so that by adjustment of the spring clips the several brakes of the train may be either simultaneously, or one or more at a time, put in action to retard or arrest the motion of the cars. Finally, I claim, generally, in my improved method of operating car brakes, the combination of main springs for pressing the brakes against the wheels, mechanism for winding up the springs, so as to remove the pressure from the brakes, and to hold the springs in a state of tension, ready to apply pressure on the brakes, instantly on being released, and mechanism to release the springs, and allow them to act both the mechanism for winding up and that for releasing the springs, being so constructed and arranged that it can be operated in either the locomotive or on the separate cars, and also capable of such adjustment that the brakes of all the cars can be either simultaneously, or one or more at a time, and any required order of succession, put in action."

113. For an *Improvement in Machinery for Operating Car Brakes;* J. Marks, Boston, and J. Howarth, Salem, Assignors to Wm. Whiting, Roxbury, Massachusetts.

Claim.—"We claim so adjusting the relative lengths of the relieving branch lines of a train of two or more cars, by means of adjustable pulleys, and connecting these lines by a single main line, that all the relieving mechanism of such train may be put in operation in such a manner that the brakes of the several cars of the train may be either simultaneously or in succession thrown out of action on the wheels, or relieved of the pressure

induced by the main spring or springs, as specified. Heretofore we have constructed the main spring of a single coil, bar, or plate of metal, which being necessarily of a high temper, in order to give it sufficient strength, and prevent it from setting, it is liable to break from a variety of causes, among others, sudden changes of temperature, and, when broken, the apparatus is entirely disabled, and the lives of those depending upon its efficiency thereby endangered; to such a spring as this we make no claim; neither do we claim a spring simply composed of two or more bars, or plates of metal; but what we do claim is, the combination and arrangement of a series of independent springs, with the mechanism for applying the force produced by their tension to press the brake rubbers upon the wheels, this mechanism being put in action either for the locomotive, or from the separate cars, by the engineer, or other person having it in charge, or automatically, and with certainty and promptness to detached cars, whenever one or more of them become detached from the train, either by design or accident, in such manner that each spring will act with its whole force, independent of all the rest, so that in case one, or any number of less than the whole of the springs shall break, the mechanism will not be thereby disabled, but merely rendered less efficient, and, as even the minimum of efficiency thus left may be sufficient to prevent an accident to the car on which the apparatus is placed, and would, in any case, lessen the damage, if it did not prevent the accident, the safety of railway traveling is thereby increased. We also claim, in combination with the main spring shaft and the frame, the apparatus by which the power of the main spring is prevented from acting too suddenly, or so as to rupture or injure the brake chain, when the slack of it is taken, as stated; meaning also to claim the combination of parts or elements constituting such apparatus, the same consisting of the wheel, the rubber, the lever, spring, catch lever, slide, with its stud, cam, spring, and the tripping cam, as specified. We also claim the mechanism for disengaging the retaining pawl of the ratchet, that is to say, the tubular shaft or sleeve, and its oblique end, acting as a stop, in combination with the windlass shaft, and its oblique end, to act in connexion with the oblique end of the sleeve, as described, so that in case the shaft should be turned back by the movement of the spring, with too much force, its screw may not bind in the screw of the sleeve, and thus prevent the apparatus from working. We also claim so combining the windlass shaft with the fusees, or apparatus by which it is put in rotation, that it may be disengaged therefrom in order to relieve the car wheels from the pressure of the brakes, without rendering it necessary to do so by rewinding the springs. We also claim the combination of the key or feather, and the locking arm, or their equivalents, with the shafts, the same being for the purpose as specified. We also claim the improvement by which each windlass or pulley shaft, and its main line, is connected, viz: by a branch line or loose pulley and friction screw or contrivance, as combined together, and with the main line and windlass shaft, and made to operate in manner substantially as specified."

114. For an *Improved Device for Tonguing and Grooving Tapering Boards;* John Abersterdam and W. B. Merrill, Boston, Assignors to J. A. Woodbury, Winchester, and W. B. Merrill, Boston, Massachusetts.

Claim.—"We claim, 1st, Giving to the tonguing and grooving cutters, a motion either towards or away from the edge of the board, so as to adapt them to boards of different widths, or of a tapering shape, by means of the traveling carriage, with its adjustable cross bar, operating upon the guide and connecting bar attached to the slide which carries the cutters, substantially as described. 2d, Giving to the traveling carriage a quick or slow motion, proportionate to the length of the board to be jointed, so as to convey a similar motion to the tonguing and grooving cutters by means of the adjustable sliding bar, band, and cones, operating together, substantially as described."

115. For an *Improvement in Stereotype Pans;* Richard D. Mott, Philadelphia, Pa.

Claim.—"I do not claim the pan proper, nor its lid, as these are common; but what I claim is, the substitution and use, in stereotype pans, of a single horizontal casting plate, combined with the adjustable attachments, for holding the single-faced plaster moulds, the said attachments having chisel-like cutting edges on their ends, for cutting and trimming the said mould as they are forced, by the operator, between them and the plate; and the said casting plate having both its sides fitted with the cutting edged attachments, all constructed substantially as described."

116. For an *Improvement in Feed Motion for Sawing Lumber;* Nicholas G. Norcross, Lowell, Massachusetts.

Claim.—"What I claim is, the method of regulating the velocity of the feed rollers of

a gang of saws, viz: by a sliding wheel made to operate against the side of a wheel, and to be applied to the shaft, and pressed against the wheel, all substantially as specified."

117. For *Improvements in Machines for Forming Cultivators' Teeth;* D. B. Rogers, Pittsburgh, Pennsylvania.

Claim.—"What I claim is, the arrangement of the cutter, or knife, and swaging dies, when constructed and operated substantially as described, whereby I am enabled to swage the sheet blank into shape, and to give to the foot of the tooth, by the cutter, its shape and edge, after it has been swaged into form, and when it is held firmly between the dies."

118. For an *Improvement in Harvesters;* William H. Seymour, Brockport, N. Y.

Claim.—"What I claim is, the combination of the shaft for rotating the pinion, the shaft for turning and carrying the rake and connecting the mechanism, constructed and arranged as described, whereby the rake is turned up and down, and firmly held in either position, in a simple and convenient manner, without producing an undue strain upon any part of the driving gear. Also, the adjustment of the rake at varying heights from the platform in its elevated and depressed position, by means of the device, as described, or the equivalent thereof."

119. For an *Improvement in Pumps;* Joseph Smart, Philadelphia, Pa.

Claim.—"What I claim is, 1st, The mode of applying the outward chamber for supplying the inner chamber above the piston, and discharging the same, and the manner of connecting the valves with both chambers, as described. 2d, The upper or movable valve seat, with gate attached, with the mode of securing the same to its bed by the open washer and inside screw bearing on the top of the washer, as described."

120. For an *Improvement in the Construction of Shingle Machines;* Henry C. Smith, Cleveland, Ohio.

Claim.—"I do not claim any one of the separate devices; but what I do claim is, the special and precise arrangement, and the mode of operating the devices, as set forth."

121. For a *Machine for Tenoning, &c., Blind Slats;* T. G. Stagg, Jersey City, N. J.

Claim.—"I am aware that cutters similar to the ones described, have been previously used on rotating disks of similar purposes; I therefore do not claim the cutters, separately; but what I claim is, 1st, The employment or use of the stationary knives and the cutters, arranged upon a rotary disk, the knives and disk, with the cutters attached, being secured to a vibrating head, two heads being employed on one machine, and operating in the manner substantially as described. 2d, The employment or use of the clamp lever, and staple or pricking lever, arranged and operating as described, for the purpose of properly clamping the slat and pricking the same, or driving the staple therein."

122. For an *Improvement in Furnaces for Zinc White;* Jonathan G. Trotter, Newark, New Jersey.

Claim.—"What I claim is, the combination and use of the upper and lower discharge or passage ways from the fire-place to the furnace; that is, the upper passage way for discharging or carrying off the lighter gases from the fire-place, by the reverberatory flue and return flues, and to the chimney and the lower passage ways, for discharging the flame from the fire-place direct upon the mass of ore on the bed of the furnace, and thereby reducing or subliming it more effectually and with less consumption of fuel than ever before accomplished. Also, the combination of the alternating series of bridges or brakes in the return flues, with the reverberatory flue, doubled arched conformation of the roof of the furnace, and the upper passage way and lower passage ways from the furnace, for the purpose of working zinc ores for making white oxide of zinc, substantially as set forth."

123. For an *Improved Oil Cup for Steam Engines;* Geo. Trott, Pittsburgh, Pa.

Claim.—"What I claim is, the arrangement of a double valve, and the passages for feeding and discharging the oil, in the manner described."

124. For an *Improvement in Machines for Bending Sheet Metal;* William Webster, Morrisania, New York.

Claim.—"What I claim is, the non-axled cylinder, as arranged in relation to the rollers

and mandrel, whereby I am enabled readily to adapt it to rolling and bending sheet metal, as described."

125. For an *Improvement in Railroad Car Wheels;* R. A. Wilder, Schuylkill Haven, Pennsylvania.

Claim.—"What I claim is, the groove in the wheel near the flanch, and, in combination therewith, the convex form of the tread."

126. For an *Improvement in Track Cleaners for Railroads;* Edward H. Ashcroft, Boston, Massachusetts.

Claim.—"What I claim is, the method of cleaning snow or ice, or other like obstacles, from grooved railroad rails, by means of a picker and mould-board, or scraper, substantially as described."

127. For an *Improvement in Cooking Stoves;* Joseph Leeds, Philadelphia, Pa.

"The nature of my invention consists in forming the fire box, or chamber, of a series of vertical pipes or tubes, through which air passes from a receiving air chamber underneath. which is entirely separated from the ash box, and becomes highly heated, and passes up underneath the top plate, and around the oven, for cooking or baking purposes, and in so arranging the oven, into which hot air may be introduced, if required, as that none of its sides or plates shall be in contact with the heated products of combustion, but be surrounded by hot air, by which means the most perfect regulation of heat may be kept therein."

Claim.—"What I claim is, 1st, A fire box, formed or composed of a series of vertical tubes, through which air is introduced to be heated, in combination with the air space under the top plate, and around the oven, substantially as described. Also, so arranging the oven as it shall not be in contact with any of the plates which are directly in contact with the heated products of combustion, but be heated by hot air, substantially as described."

128. For an *Improved Hand Printing Press;* Henry Underhill, Canandaigua, N. Y.

Claim.—"What I claim is, the method of operating the platen by hand, intermittently, in connexion with a reciprocating double frisket carriage, whose movement is derived from a continuous rotary motion, whether produced by hand or power, so that as the carriage brings the frisket of each end alternately under the platen, the latter may be made to descend at the will of the attendant, and independently of the movement of the carriage, so its depression may be omitted if a blank sheet is not placed over the form, substantially as described."

129. For an *Improvement in Sacket's Braiding Machine;* Ephraim Sizer, Titus Sizer, Emerson Sizer, and Amos Halladay, Westfield, Massachusetts.

Claim.—"What we claim is, the construction of the racers with the guides, substantially as described. Also, the combination of the spring guides, with the flanches, on the carriers, substantially as set forth. We further claim guiding the racers by means of spring and tail-guides, operating on the interior or exterior of the shell or circle, substantially as set forth."

130. For an *Improved Method of Operating the Doctors of Calico-Printing Cylinders;* James Bavendale, Fall River, Assignor to himself and James Ferguson, Taunton, Massachusetts.

Claim.—"I claim a compound traverse mechanism, constructed of eccentric gears and a pinion gear, and a supporting frame, substantially as described, as applied for obtaining a compound traverse, or constantly variable reciprocating movement of the doctor of a calico-printing roller."

Additional Improvement.

1. For an *Apparatus for Opening and Closing Gates;* Samuel G. Dugdale, Richmond, Indiana; dated March 7, 1854; original letters patent dated Oct. 11, 1853; re-issued January 31, 1854.

Claim.—"What I claim is, the application of a pendulous lever provided with a notch, or its equivalent, in the manner and for the purpose as set forth."

Re-Issues for March, 1854.

1. For an *Improved Shingle Machine;* Enoch R. Morrison, Troy, Pennsylvania; dated November 22, 1853; re-issued March 7, 1854.

Claim.—"What I claim is, riving and carrying forward of the riven shingle, by the intermittently reciprocating movement of the riving knife stock or frame, so as to be operated upon successively by the shaving and edging knives, said motion being imparted by the movement of the riving knife stock through the intervention of the spring hooks, stops, or dogs, or their equivalents, substantially as described."

2. For *Improvements in Substrata for Pavements;* Horace P. Russ, N. York; original letters patent dated March 14, 1848; re-issued March 28, 1854.

Claim.—"I do not claim any of the materials or parts described, as used herein, all being well known; but I do claim, 1st, Leaving seams, or other openings, in the concrete foundation, substantially in the manner described, that the direct escape of the water, gas, &c., may indicate the point or points at which repairs in the pipes are required. 2d, The constructing of panels or sections to the concrete foundation, to give access to pipes and conduits below, by the application and combination therewith of frames formed of any suitable material, with the thinner edge upwards, to allow the concrete mass to be lifted out when necessary, substantially as described, when this is combined with a paved roadway of any kind laid thereon, as described."

Designs for March, 1854.

1. For a *Panel Ornament for Stoves, &c.;* Isaac De Zouche, Assignor to Louis Potter, Troy, New York; dated March 14, 1854.

"The design of my panel ornament consists of the flowers and stem, leaves, shells, and centre pieces, combined and arranged."

Claim.—"What I claim is, the ornamental configuration and arrangement of the parts."

2. For *Stoves;* John F. Allen and Joseph Stewart, Assignors to North, Chase and North, Philadelphia, Pennsylvania; dated March 21, 1854.

Claim.—"We claim the design and configuration of the ornaments and mouldings described."

3. For *Cooking Stoves;* Samuel D. Vose, Albany, New York; dated March 28, 1854.

Claim.—"I do not claim any separate figure or ornament, or any of these parts; what I claim is, the arrangement of the several figures and mouldings, combined together."

4. For *Coal Stoves;* Samuel D. Vose, Albany, New York; dated March 28, 1854.

Claim.—"I do not claim any separate ornament upon either of these plates or parts; what I claim is, the combination and arrangement of the several figures and mouldings."

LAW REPORTS OF PATENT CASES.

Telegraph Case in the Supreme Court of the United States.

HENRY O'RIELLY, EUGENE L. WHITMAN, AND W. F. B. HASTINGS, *Appellants*, *vs.* SAMUEL F. B. MORSE, ALFRED VAIL, AND FRANCIS O. J. SMITH, *Appellees.*

1. Morse's invention of the telegraph was prior to that of Steinheil, Wheatstone, or Davy.—(Unanimous decision of Court.)
2. Morse's invention is different from, and superior to, those of Steinheil, Wheatstone, and Davy.
3. The fact that Morse sought and obtained from men of science, information and advice, neither impairs his rights as an inventor nor detracts from his merits. (Unanimous.)
4. Morse's patent of 1840, is not void by reason of not corresponding in date with the French patent. (Unanimous.)
5. In the opinion of Justices Taney, M'Lean, Catron, and Daniels, the eighth claim of Professor Morse's patent of 1840, is broader than the law warrants; but this does not invalidate the whole patent, because there has been no unreasonable delay in entering a disclaimer.

   Justices Nelson, Wayne, and Grier, held the eighth claim to be valid, and dissented from the four other Justices on this point.*
6. Morse's second patent, or local circuit patent, being for an improvement upon a machine already patented by him, is not, on that account, void. (Unanimous.)
7. A patentee improving upon a former invention patented by himself, may either annex the improvement to his former specification, or take out a new and distinct patent for such improvement. (Unanimous.)
8. The local circuit patent is for a distinct invention not described in the first patent, and is therefore valid. (Unanimous.)
9. The defendants have infringed both of Morse's patents, and the decree of the Court below awarding a perpetual injunction, must be affirmed. (Unanimous.)
10. In the opinion of Justices Taney, M'Lean, Catron, and Daniels, the complainants are not entitled to costs.†

    Justices Grier, Nelson, and Wayne, dissented on the last point, and held that the complainants should be entitled to costs.

This case was brought up by an appeal from a decision of the Circuit Court of the United States for the District of Kentucky.

The appeal was argued in 1853 by General GILLETT and Hon. S. P. CHASE, for the Appellants; and GEORGE HARDING, ST. GEORGE T. CAMPBELL, and GEORGE GIFFORD, for the Appellees; after which, the Court held the case under advisement, and entered the following decision in February, 1854.

* The Supreme Court is composed of nine Justices. At the time of the hearing this cause, there were but seven Justices present; there being one vacancy in the Court, caused by the death of Justice M'Kinley, and Justice Curtis declining to sit, on account of his former professional relations to the Morse patents. The opinion of the four Justices on this point cannot, therefore, be regarded as the final decision of the Court on this important question of patent law.

† The costs here refused, are only the taxable costs of Court, and must be distinguished from damages for the infringement, the right to recover which, still belongs to the complainants.

Mr. Chief Justice Taney delivered the opinion of the Court, as follows:—

In proceeding to pronounce judgment in this case, the Court is sensible, not only of its importance, but of the difficulties in some of the questions which it presents for decision. The case was argued at the last Term, and continued over by the Court for the purpose of giving it a more deliberate examination. And since the continuance, we have received from the counsel on both sides printed arguments, in which all of the questions raised on the trial have been fully and elaborately discussed.

The appellants take three grounds of defence: In the first place, they deny that Professor Morse was the first and original inventor of the Electro-Magnetic Telegraphs, described in his two reissued patents of 1848. Secondly, they insist that if he was the original inventor, the patents under which he claims have not been issued conformably to the acts of Congress, and do not confer on him the right to the exclusive use. And thirdly, if these two propositions are decided against them, they insist that the Telegraph of O'Rielly is substantially different from that of Professor Morse, and the use of it, therefore, no infringement of his rights.

In determining these questions, we shall, in the first instance, confine our attention to the patent which Professor Morse obtained in 1840, and which was reissued in 1848. The main dispute between the parties is upon the validity of this patent; and the decision upon it will dispose of the chief points in controversy in the other.

In relation to the first point, (the originality of the invention,) many witnesses have been examined on both sides.

It is obvious that, for some years before Professor Morse made his invention, scientific men in different parts of Europe were earnestly engaged in the same pursuit. Electro-Magnetism itself was a recent discovery, and opened to them a new and unexplored field for their labors, and minds of a high order were engaged in developing its power, and the purposes to which it might be applied.

Professor Henry, of the Smithsonian Institute, states in his testimony, that prior to the winter of 1819-20, an Electro-Magnetic Telegraph—that is to say, a Telegraph operating by the combined influence of electricity and magnetism—was not possible; that the scientific principles on which it is founded were until then unknown; and that the first fact of Electro-Magnetism was discovered by Oersted, of Copenhagen, in that winter, and was widely published, and the account everywhere received with interest.

He also gives an account of the various discoveries subsequently made from time to time, by different persons in different places, developing its properties and powers; and among them his own. He commenced his researches in 1828, and pursued them with ardor and success from that time until the Telegraph of Professor Morse was established and in actual operation. And it is due to him to say that no one has contributed more to enlarge the knowledge of Electro-Magnetism, and to lay the foundations of the great invention of which we are speaking, than the Professor himself.

It is unnecessary, however, to give in detail the discoveries enumerated by him—either his own, or those of others. But it appears from his testimony, that very soon after the discovery made by Oersted, it was believed by men of science that this newly-discovered power might be used to communicate intelligence to distant places. And before the year 1823, Ampère, of Paris, one of the most successful cultivators of physical science, proposed to the French Academy a plan for that purpose. But his project was never reduced to practice. And the discovery made by Barlow, of the Royal Military Academy at Woolwich, England, in 1825, that the galvanic current greatly diminished in power as the distance increased, put at rest for a time all attempts to construct an Electro-Magnetic Telegraph. Subsequent discoveries, however, revived the hope; and in the year 1832, when Professor Morse appears to have devoted himself to the subject, the conviction was general among men of science everywhere, that the object could, and, sooner or later, would be accomplished.

The great difficulty in their way was the fact that the galvanic current, however strong in the beginning, became gradually weaker as it advanced on the wire; and was not strong enough to produce mechanical effect after a certain distance had been traversed. But encouraged by the discoveries which were made from time to time, and strong in the belief that an Electro-Magnetic Telegraph was practicable, many eminent and scientific men in Europe, as well as in this country, became deeply engaged in endeavoring to surmount what appeared to be the chief obstacle to its success. And in this state of things, it ought not to be a matter of surprise, that four different Magnetic Telegraphs, purporting to have overcome the difficulty, should be invented, and made public so nearly at the same time that each has claimed a priority; and that a close and careful scrutiny of the facts in each case is necessary to decide between them. The inventions were so nearly simultaneous, that neither inventor can be justly accused of having derived any aid from the discoveries of the other.

One of these inventors, Doctor Steinheil, of Munich, in Germany, communicated his discovery to the Academy of Science in Paris, on the 19th of July, 1838, and states in his communication that it had been in operation more than a year.

Another of the European inventors, Professor Wheatstone, of London, in the month of April, 1837, explained to Professors Henry and Bache, who were then in London, his plan of an Electro-Magnetic Telegraph, and exhibited to them his method of bringing into action a second galvanic circuit in order to provide a remedy for the diminution of force in a long circuit; but it appears by the testimony of Professor Gale, that the patent to Wheatstone & Cooke was not sealed until January 21, 1840, and their specification was not filed until the 21st of July, in the same year; and there is no evidence that any description of it was published before 1839.

The remaining European patent is that of Edward Davy. His patent, it appears, was sealed on the 4th of July, 1838, but his specification was not filed until January 4, 1839; and when these two English patents are brought into competition with that of Morse, they must take date from

the time of filing their respective specifications. For it must be borne in mind that, as the law then stood in England, the inventor was allowed six months to file the description of his invention after his patent was sealed, while, in this country, the filing of the specification is simultaneous with the application for patents.

The defendants contend that all, or at least some one of these European Telegraphs, were invented and made public before the discovery claimed by Morse; and that the process and method by which he conveys intelligence to a distance is substantially the same, with the exception only of its capacity for impressing upon paper the marks or signs described in the alphabet he invented.

Waiving, for the present, any remarks upon the identity or similitude of these inventions, the Court is of opinion that the first branch of the objection cannot be maintained, and that Morse was the first and original inventor of the Telegraph described in his specification, and preceded the three European inventions relied on by the defendants.

The evidence is full and clear that when he was returning from a visit to Europe, in 1832, he was deeply engaged upon this subject during the voyage; and that the process and means were so far developed and arranged in his own mind, that he was confident of ultimate success. It is in proof that he pursued these investigations with unremitting ardor and industry, interrupted occasionally by pecuniary embarrassments; and we think that it is established by the testimony of Professor Gale and others, that early in the spring of 1837, Morse had invented his plan for combining two or more Electric or Galvanic Circuits, with independent Batteries, for the purpose of overcoming the diminished force of Electro-Magnetism in long circuits, although it was not disclosed to the witness until afterwards; and that there is reasonable ground for believing that he had so far completed his invention, that the whole process, combination, powers, and machinery, were arranged in his mind, and that the delay in bringing it out arose from his want of means; for it required the highest order of mechanical skill to execute and adjust the nice and delicate work necessary to put the Telegraph into operation, and the slightest error or defect would have been fatal to its success. He had not the means at that time to procure the services of workmen of that character; and without their aid no model could be prepared which would do justice to his invention; and it moreover required a large sum of money to procure proper materials for the work. He, however, filed his caveat on the 6th of October, 1837, and on the 7th of April, 1838, applied for his patent, accompanying his application with a specification of his invention, and describing the process and means used to produce the effect. It is true that O'Rielly in his answer alleges that the plan by which he now combines two or more galvanic or electric currents, with independent batteries, was not contained in that specification, but discovered and interpolated afterwards; but there is no evidence whatever to support this charge. And we are satisfied from the testimony, that the plan, as it now appears in his specification, had then been invented, and was actually intended to be described.

With this evidence before us, we think it is evident that the invention of Morse was prior to that of Steinheil, Wheatstone, or Davy. The dis-

covery of Steinheil, taking the time which he himself gave to the French Academy of Science, cannot be understood as carrying it back beyond the months of May or June, 1837; and that of Wheatstone, as exhibited to Professors Henry and Bache, goes back only to April in that year. And there is nothing in the evidence to carry back the invention of Davy beyond the 4th of January, 1839, when his specification was filed, except a publication said to have been made in the *London Mechanics' Magazine*, January 20, 1838; and the invention of Morse is justly entitled to take date from early in the spring of 1837. And in the description of Davy's invention, as given in the publication of January 20, 1838, there is nothing specified which Morse could have borrowed; and we have no evidence to show that his invention ever was or could be carried into successful operation.

In relation to Wheatstone, there would seem to be some discrepancy in the testimony. According to Professor Gale's testimony, as before mentioned, the specification of Wheatstone and Cooke was not filed until July 21, 1840, and his information is derived from the *London Journal of Arts and Sciences*. But it appears by the testimony of Edward F. Barnes, that this Telegraph was in actual operation in 1839. And in the case of the Electric Telegraph Company *vs.* Brett & Little, 10 Common Pleas Reports, by Scott, his specification is said to have been filed Dec. 12, 1837. But if the last mentioned date is taken as the true one, it would not make his invention prior to that of Morse. And even if it would, yet this case must be decided by the testimony in the record, and we cannot go out of it, and take into consideration a fact stated in a book of reports. Moreover, we have noticed this case merely because it has been pressed into the argument. The appellants do not mention it in their answer, nor put their defence on it. And if the evidence of its priority was conclusive, it would not avail them in this suit. For they cannot be allowed to surprise the patentee by evidence of a prior invention of which they gave him no notice.

But if the priority of Morse's invention was more doubtful, and it was conceded that in fact some one of the European inventors had preceded him a few months or a few weeks, it would not invalidate his patent. The act of Congress provides that when the patentee believes himself to be the first inventor, a previous discovery in a foreign country shall not render his patent void, unless such discovery or some substantial part of it had been before patented or described in a printed publication.

Now we suppose no one will doubt that Morse believed himself to be the original inventor when he applied for his patent in April, 1838. Steinheil's discovery does not appear to have been ever patented, nor to have been described in any printed publication until July of that year. And neither of the English inventions are shown by the testimony to have been patented until after Morse's application for a patent, nor to have been so described in any previous publication as to embrace any substantial part of his invention. And if his application for a patent was made under such circumstances, the patent is good, even if, in point of fact, he was not the first inventor.

In this view of the subject, it is unnecessary to compare the Telegraph of Morse with these European inventions, to ascertain whether they are

substantially the same or not. If they were the same in every particular, it would not impair his rights. But it is impossible to examine them, and look at the process and the machinery and results of each, so far as the facts are before us, without perceiving at once the substantial and essential difference between them, and the decided superiority of the one invented by Professor Morse.

Neither can the inquiries he made, nor the information or advice he received from men of science, in the course of his researches, impair his right to the character of an inventor. No invention can possibly be made, consisting of a combination of different elements of power, without a thorough knowledge of the properties of each of them, and the mode in which they operate on each other. And it can make no difference in this respect whether he derives his information from books, or from conversation with men skilled in the science. If it were otherwise, no patent in which a combination of different elements is used, could ever be obtained. For no man ever made such an invention without having first obtained this information, unless it was discovered by some fortunate accident. And it is evident that such an invention as the Electro-Magnetic Telegraph could never have been brought into action without it. For a very high degree of scientific knowledge, and the nicest skill in the mechanic arts, are combined in it, and were both necessary to bring it into successful operation. And the fact that Morse sought and obtained the necessary information and counsel from the best sources, and acted upon it, neither impairs his rights as an inventor, nor detracts from his merits.

Regarding Professor Morse as the first and original inventor of the Telegraph, we come to the objections which have been made to the validity of his patent.

We do not think it necessary to dwell upon the objections taken to the proceedings upon which the first patent was issued, or to the additional specifications in the reissued patent of 1848. In relation to the first, if there was any alteration, at the suggestion of the Commissioner, it appears to have been in a matter of form rather than of substance; and as regards the second, there is nothing in the proof, or on the face of the reissued patent, to show that the invention therein described is not the same with the one intended to be secured by the original patent. It was reissued by the proper lawful authority, and it was the duty of the Commissioner of Patents to see that it did not cover more than the original invention. It must be presumed, therefore, that it does not, until the contrary appears. Variations from the description given in the former specification do not necessarily imply that it is for a different discovery. The right to surrender the old patent, and receive another in its place, was given for the purpose of enabling the patentee to give a more perfect description of his invention, when any mistake or oversight was committed in his first. It necessarily, therefore, varies from it. And we see nothing in the reissued patent that may not, without proof to the contrary, be regarded as a more careful description than the former one, explaining more fully the nice and delicate manner in which the different elements of power are arranged and combined together and act upon one another, in order to produce the effect described in the specification.

Nor is it void because it does not bear the same date with his French patent. It is not necessary to inquire whether the application of Professor Morse to the Patent Office, in 1838, before he went to France, does or does not exempt his patent from the operation of the act of Congress upon this subject. For if it should be decided that it does not exempt it, the only effect of that decision would be to limit the monopoly to fourteen years from the date of the foreign patent. And in either case the patent was in full force at the time the injunction was granted by the Circuit Court, and when the present appeal stood regularly for hearing in this Court.

And this brings us to the exceptions taken to the specification and claims of the patentee in the reissued patent of 1848.

We perceive no well-founded objection to the description which is given of the whole invention and its separate parts, nor to his right to a patent for the first seven inventions set forth in the specification of his claims. The difficulty arises on the eighth.

It is in the following words:

"Eighth. I do not propose to limit myself to the specific machinery or parts of machinery described in the foregoing specification and claims; the essence of my invention being the use of the motive power of the electric or galvanic current, which I call Electro-Magnetism, however developed, for marking or printing intelligible characters, signs, or letters, at any distances, being a new application of that power of which I claim to be the first inventor or discoverer."

It is impossible to misunderstand the extent of this claim. He claims the exclusive right to every improvement where the motive power is the electric or galvanic current, and the result is the marking or printing intelligible characters, signs, or letters, at a distance.

If this claim can be maintained, it matters not by what process or machinery the result is accomplished. For aught that we now know, some future inventor in the onward march of science may discover a mode of writing or printing at a distance, by means of the electric or galvanic current, without using any part of the process or combination set forth in the plaintiff's specification. His invention may be less complicated—less liable to get out of order—less expensive in construction and in its operation. But yet, if it is covered by this patent, the inventor could not use it, nor the public have the benefit of it, without the permission of this patentee.

Nor is this all. While he shuts the door against inventions of other persons, the patentee would be able to avail himself of new discoveries in the properties and powers of Electro-Magnetism which scientific men might bring to light. For he says he does not confine his claims to the machinery or parts of machinery which he specifies: but claims for himself a monopoly in its use, however developed, for the purpose of printing at a distance. New discoveries in physical science may enable him to combine it with new agents and new elements, and by that means attain the object in a manner superior to the present process, and altogether different from it. And if he can secure the exclusive use, by his present patent, he may vary it with every new discovery and developement of the science, and need place no description of the new manner,

process, or machinery, upon the records of the Patent Office. And when his patent expires, the public must apply to him to learn what it is. In fine, he claims an exclusive right to use a manner and process which he has not described, and indeed had not invented, and therefore could not describe when he obtained his patent. The Court is of opinion that the claim is too broad, and not warranted by law.

No one, we suppose, will maintain that Fulton could have taken out a patent for his invention of propelling vessels by steam, describing the process and machinery he used, and claimed under it the exclusive right to use the motive power of steam, however developed, for the purpose of propelling vessels. It can hardly be supposed that under such a patent he could have prevented the use of the improved machinery which science has since introduced; although the motive power is steam, and the result is the propulsion of vessels. Neither could the man who first discovered that steam might, by a proper arrangement of machinery, be used as a motive power to grind corn or spin cotton, claim the right to the exclusive use of steam, as a motive power, for the purpose of producing such effects.

Again, the use of steam as a motive power in printing presses is comparatively a modern discovery. Was the first inventor of a machine or process of this kind entitled to a patent, giving him the exclusive right to use steam as a motive power, however developed, for the purpose of marking or printing intelligible characters? Could he have prevented the use of any other press subsequently invented, where steam was used? Yet so far as patentable rights are concerned, both improvements must stand on the same principles. Both use a known motive power to print intelligible marks or letters; and it can make no difference, in their legal rights under the patent laws, whether the printing is done near at hand or at a distance. Both depend for success not merely upon the motive power, but upon the machinery with which it is combined. And it has never, we believe, been supposed by any one, that the first inventor of a steam printing-press was entitled to the exclusive use of steam, as a motive power, however developed, for marking or printing intelligible characters.

Indeed, the acts of the patentee himself are inconsistent with the claim made in his behalf. For in 1846 he took out a patent for his new improvement of local circuits, by means of which intelligence could be printed at intermediate places along the main line of the Telegraph; and he obtained a reissued patent for this invention in 1848. Yet in this new invention the electric or galvanic current was the motive power, and writing at a distance the effect. The power was undoubtedly developed by new machinery and new combinations. But if his 8th claim could be sustained, this improvement would be embraced by his first patent. And if it was so embraced, his patent for the local circuits would be illegal and void. For he could not take out a subsequent patent for a portion of his first invention, and thereby extend his monopoly beyond the period limited by law.

Many cases have been referred to in the argument, which have been decided upon this subject, in the English and American courts. We shall speak of those only which seem to be considered as leading ones.

And those most relied on, and pressed upon the Court, in behalf of the patentee, are the cases which arose in England upon Neilson's patent for the introduction of heated air between the blowing apparatus and the furnace in the manufacture of iron.

The leading case upon this patent is that of Neilson and others *vs.* Harford and others, in the English Court of Exchequer. It was elaborately argued, and appears to have been carefully considered by the Court. The case was this:—

Neilson in his specification described his invention as one for the improved application of air to produce heat in fires, forges, and furnaces, where a blowing apparatus is required. And it was to be applied as follows:—The blast or current of air produced by the blowing apparatus was to be passed from it into an air-vessel or receptacle made sufficiently strong to endure the blast; and through or from that vessel or receptacle by means of a tube, pipe, or aperture, into the fire: the receptacle to be kept artificially heated to a considerable temperature by heat externally applied. He then described in rather general terms the manner in which the receptacle might be constructed and heated, and the air conducted through it to the fire: stating that the form of the receptacle was not material, nor the manner of applying heat to it. In the action above mentioned for the infringement of this patent, the defendant, among other defences, insisted—that the machinery for heating the air and throwing it hot into the furnace was not sufficiently described in the specification, and the patent void on that account—and also, that a patent for throwing hot air into the furnace, instead of cold, and thereby increasing the intensity of the heat, was a patent for a principle, and that a principle was not patentable.

Upon the first of these defences the jury found that a man of ordinary skill and knowledge of the subject, looking at the specification alone, could construct such an apparatus as would be productive of a beneficial result sufficient to make it worth while to adapt it to the machinery in all cases of forges, cupolas, and furnaces, where the blast is used.

And upon the second ground of defence, Baron Parke, who delivered the opinion of the Court, said:—

"It is very difficult to distinguish it from the specification of a patent for a principle, and this at first created in the minds of the Court much difficulty; but after full consideration, we think that the plaintiff does not merely claim a principle, but a machine embodying a principle, and a very valuable one. We think the case must be considered as if the principle being well known, the plaintiff had first invented a mode of applying it by a mechanical apparatus to furnaces; and his invention then consists in this: by interposing a receptacle for heated air between the blowing apparatus and the furnace. In this receptacle he directs the air to be heated by the application of heat externally to the receptacle, and thus he accomplishes the object of applying the blast, which was before cold air, in a heated state to the furnace."

We see nothing in this opinion differing in any degree from the familiar principles of law applicable to patent cases. Neilson claimed no particular mode of constructing the receptacle, or of heating it. He pointed out the manner in which it might be done; but admitted that it

might also be done in a variety of ways; and at a higher or lower temperature; and that all of them would produce the effect in a greater or less degree, provided the air was heated by passing through a heated receptacle. And hence it seems that the Court at first doubted whether it was a patent for anything more than the discovery that hot air would promote the ignition of fuel better than cold. And if this had been the construction, the Court, it appears, would have held his patent to be void; because the discovery of a principle in natural philosophy or physical science is not patentable.

But after much consideration, it was finally decided that this principle must be regarded as well known, and that the plaintiff had invented a mechanical mode of applying it to furnaces; and that his invention consisted in interposing a heated receptacle between the blower and the furnace, and by this means heating the air after it left the blower, and before it was thrown into the fire. Whoever, therefore, used this method of throwing hot air into the furnace, used the process he had invented, and thereby infringed his patent, although the form of the receptacle or the mechanical arrangements for heating it might be different from those described by the patentee. For whatever form was adopted for the receptacle, or whatever mechanical arrangements were made for heating it, the effect would be produced in a greater or less degree, if the heated receptacle was placed between the blower and the furnace, and the current of air passed through it.

Undoubtedly the principle that hot air will promote the ignition of fuel better than cold, was embodied in this machine. But the patent was not supported, because this principle was embodied in it. He would have been equally entitled to a patent, if he had invented an improvement in the mechanical arrangements of the blowing apparatus, or in the furnace, while a cold current of air was still used. But this patent was supported, because he had invented a mechanical apparatus, by which a current of hot air instead of cold could be thrown in. And this new method was protected by his patent. The interposition of a heated receptacle in any form was the novelty he invented.

We do not perceive how the claim, in the case before us, can derive any countenance from this decision. If the Court of Exchequer had said that Neilson's patent was for the discovery that hot air would promote ignition better than cold, and that he had an exclusive right to use it for that purpose, there might, perhaps, have been some reason to rely upon it. But the Court emphatically denied his right to such a patent; and his claim, as the patent was construed and supported by the Court, is altogether unlike that of the patentee before us.

For Neilson discovered that by interposing a heated receptacle between the blower and the furnace, and conducting the current of air through it, the heat in the furnace was increased. And this effect was always produced, whatever might be the form of the receptacle, or the mechanical contrivances for heating it, or for passing the current of air through it, and into the furnace.

But Professor Morse has not discovered that the electric or galvanic current will always print at a distance, no matter what may be the form of the machinery or mechanical contrivances through which it passes.

You may use Electro-Magnetism as a motive power, and yet not produce the described effect—that is, print at a distance intelligible marks or signs. To produce that effect it must be combined with and passed through and operate upon certain complicated and delicate machinery adjusted and arranged upon philosophical principles, and prepared by the highest mechanical skill. And it is the high praise of Professor Morse, that he has been able by a new combination of known powers, of which Electro-Magnetism is one, to discover a method by which intelligible marks or signs may be printed at a distance. And for the method or process thus discovered he is entitled to a patent. But he has not discovered that the Electro-Magnetic current, used as a motive power, in any other method, and with any other combination, will do as well.

We have commented on the case in the Court of Exchequer more fully, because it has attracted much attention in the courts of this country as well as in the English courts, and has been differently understood. And perhaps a mistaken construction of that decision has led to the broad claim in the patent now under consideration.

We do not deem it necessary to remark upon the other English decisions in relation to Neilson's patent, nor upon the other cases referred to, which stand upon similar principles. The observations we have made on the case in the Court of Exchequer will equally apply to all of them.

We proceed to the American decisions; and the principles herein stated were fully recognised by this Court in the case of Leroy *et al. vs.* Tatham and others, decided at the last Term, 14 How., 156.

It appeared in that case that the patentee had discovered that lead, recently set, would, under heat and pressure in a close vessel, reunite perfectly after a separation of its parts, so as to make wrought instead of cast pipe. And the Court held that he was not entitled to a patent for this newly-discovered principle or quality in lead; and that such a discovery was not patentable; but that he was entitled to a patent for the new process or method in the art of making lead pipe which this discovery enabled him to invent and employ; and was bound to describe such process or method fully in his specification.

Many cases have also been referred to which were decided in the Circuit Courts. It will be found, we think, upon careful examination, that all of them, previous to the decision on Neilson's patent, maintained the principles on which this decision is made. Since that case was reported, it is admitted that decisions have been made which would seem to extend patentable rights beyond the limits here marked out. As we have already said, we see nothing in that opinion which would sanction the introduction of any new principle in the law of patents; but if it were otherwise, it would not justify this Court in departing from what we consider as established principles in the American courts. And to show what was heretofore the doctrine upon this subject, we refer to the annexed cases. We do not stop to comment on them, because such an examination would extend this opinion beyond all reasonable bounds. 1 Stor. Rep. 270, 285; Wyeth *vs.* Stone, 3 Sumn. 540; Blanchard *vs.* Sprague. The first-mentioned case is directly in point.

Indeed, independently of judicial authority, we do not think that the language used in the act of Congress can justly be expounded otherwise.

The 5th section of the act of 1836 declares that a patent shall convey to the inventor, for a term not exceeding fourteen years, the exclusive right of making, using, and vending to others to be used, his invention or discovery, referring to the specification for the particulars thereof.

The 6th section directs who shall be entitled to a patent, and the terms and conditions on which it may be obtained. It provides that any person shall be entitled to a patent who has discovered or invented a new and useful art, machine, manufacture, or composition of matter, or a new and useful improvement on any previous discovery in either of them. But before he receives a patent, he shall deliver a written description of his invention or discovery, "*and of the manner and process of making, constructing, using, and compounding the same*," in such exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, and use the same.

This Court has decided that the specification required by this law is a part of the patent, and that the patent issues for the invention described in the specification.

Now whether the Telegraph is regarded as an art or machine, the manner and process of making or using it must be set forth in exact terms. The act of Congress makes no difference in this respect between an art and a machine. An improvement in the art of making bar iron or spinning cotton must be so described, and so must the art of printing by the motive power of steam. And in all of these cases, it has always been held that the patent embraces nothing more than the improvement described and claimed as new, and that any one who afterwards discovered a method of accomplishing the same object, substantially and essentially differing from the one described, had a right to use it. Can there be any good reason why the art of printing at a distance, by means of the motive power of the electric or galvanic current, should stand on different principles? Is there any reason why the inventor's patent should cover broader ground? It would be difficult to discover anything in the act of Congress which would justify this distinction. The specification of this patentee describes his invention or discovery, and the manner and process of constructing and using it, and his patent, like inventions in the other arts above mentioned, covers nothing more.

The provisions of the acts of Congress in relation to patents may be summed up in a few words.

Whoever discovers that a certain useful result will be produced in any art, machine, manufacture or composition of matter, by the use of certain means, is entitled to a patent for it; provided he specifies the means he uses in a manner so full and exact, that any one skilled in the science to which it appertains can, by using the means he specifies, without any addition to, or subtraction from, them, produce precisely the result he describes. And if this cannot be done by the means he describes, the patent is void. And if it can be done, then the patent confers on him the exclusive right to use the means he specifies to produce the result or effect he describes, and nothing more. And it makes no difference in this respect whether the effect is produced by chemical agency or combination; or by the application of discoveries or principles in natural

philosophy, known or unknown before his invention; or by machinery acting altogether upon mechanical principles. In either case, he must describe the manner and process as above mentioned, and the end it accomplishes. And any one may lawfully accomplish the same end without infringing the patent, if he uses means substantially different from those described.

Indeed, if the 8th claim of the patentee can be maintained, there was no necessity for any specification, further than to say that he had discovered that by using the motive power of Electro-Magnetism, he could print intelligible characters at any distance. We presume it will be admitted on all hands that no patent could have issued on such a specification. Yet this claim can derive no aid from the specification filed. It is outside of it, and the patentee claims beyond it. And if it stands, it must stand simply on the gronnd that the broad terms above mentioned were a sufficient description, and entitled him to a patent in terms equally broad. In our judgment, the act of Congress cannot be so construed.

The patent then being illegal and void, so far as respects the 8th claim, the question arises whether the whole patent is void, unless this portion of it is disclaimed in a reasonable time after the patent issued.

It has been urged on the part of the complainants that there is no necessity for a disclaimer in a case of this kind. That it is required in those cases only in which the party commits an error in fact, in claiming something which was known before, and of which he was not the first discoverer; that in this case he was the first to discover that the motive power of Electro-Magnetism might be used to write at a distance; and that his error, if any, was a mistake in law in supposing his invention, as described in his specification, authorized this broad claim of exclusive privilege; and that the claim, therefore, may be regarded as a nullity, and allowed to stand in the patent without a disclaimer, and without affecting the validity of the patent.

This distinction can hardly be maintained. The act of Congress above recited requires that the invention shall be so described, that a person skilled in the science to which it appertains, or with which it is most nearly connected, shall be able to construct the improvement from the description given by the inventor.

Now in this case there is no description but one of a process by which signs or letters may be printed at a distance. And yet he claims the exclusive right to any other mode and any other process, although not described by him, by which the end can be accomplished, if Electro-Magnetism is used as the motive power. That is to say, he claims a patent for an effect produced by the use of Electro-Magnetism distinct from the process or machinery necessary to produce it. The words of the act of Congress above quoted show that no patent can lawfully issue upon such a claim. For he claims what he has not described in the manner required by law. And a patent for such a claim is as strongly forbidden by the act of Congress as if some other person had invented it before him.

Why, therefore, should he be required and permitted to disclaim in the one case and not in the other? The evil is the same if he claims

more than he has invented, although no other person has invented it before him. He prevents others from attempting to improve upon the manner and process which he has described in his specification, and may deter the public from using it, even if discovered. He can lawfully claim only what he has invented and described, and if he claims more his patent is void. And the judgment in this case must be against the patentee, unless he is within the act of Congress which gives the right to disclaim.

The law which requires and permits him to disclaim is not penal, but remedial. It is intended for the protection of the patentee as well as the public, and ought not, therefore, to receive a construction that would restrict its operation within narrower limits than its words fairly import. It provides, "that when any patentee shall have in his specification claimed to be the first and original inventor or discoverer of any material or substantial part of the thing patented, of which he was not the first and original inventor, and shall have no legal or just claim to the same,"—he must disclaim in order to protect so much of the claim as is legally patented.

Whether, therefore, the patent is illegal in part, because he claims more than he has sufficiently described, or more than he invented, he must in either case disclaim, in order to save the portion to which he is entitled; and he is allowed to do so when the error was committed by mistake.

A different construction would be unjust to the public, as well as to the patentee, and defeat the manifest object of the law, and produce the very evil against which it intended to guard.

It appears that no disclaimer has yet been entered at the Patent Office. But the delay in entering it is not unreasonable. For the objectionable claim was sanctioned by the head of the office; it has been held to be valid by a Circuit Court, and differences of opinion in relation to it are found to exist among the justices of this Court. Under such circumstances, the patentee had a right to insist upon it, and not disclaim it until the highest court to which it could be carried had pronounced its judgment. The omission to disclaim, therefore, does not render the patent altogether void, and he is entitled to proceed in this suit for an infringement of that part of his invention which is legally claimed and described. But as no disclaimer was entered in the Patent Office before this suit was instituted, he cannot, under the act of Congress, be allowed costs against the wrong-doer, although the infringement should be proved. And we think it is proved by the testimony. But as the question of infringement embraces both of the reissued patents, it is proper, before we proceed to that part of the case, to notice the objections made to the second patent for the local circuits, which was originally obtained in 1846 and reissued in 1848.

It is certainly no objection to this patent, that the improvement is embraced by the eighth claim in the former one. We have already said that this claim is void, and that the former patent covers nothing but the first seven inventions specifically mentioned.

Nor can its validity be impeached upon the ground that it is an improvement upon a former invention, for which the patentee had himself already obtained a patent. It is true that, under the act of 1836, S. 13,

it was in the power of Professor Morse, if he desired it, to annex this improvement to his former specification, so as to make it from that time a part of the original patent. But there is nothing in the act that forbids him to take out a new patent for the improvement, if he prefers it. Any other inventor might do so; and there can be no reason, in justice or in policy, for refusing the like privilege to the original inventor. And when there is no positive law to the contrary, he must stand on the same footing with any other inventor of an improvement upon a previous discovery. Nor is he bound in his new patent to refer specially to his former one. All that the law requires of him is, that he shall not claim as new what is covered by a former invention, whether made by himself or any other person.

It is said, however, that this alleged improvement is not new, and is embraced in his former specification; and that if some portion of it is new, it is not so described as to distinguish the new from the old.

It is difficult, perhaps impossible, to discuss this part of the case so as to be understood by any one who has not a model before him, or perfectly familiar with the machinery and operations of the Telegraph. We shall not, therefore, attempt to describe minutely the machinery or its mode of operation. So far as this can be done intelligibly, without the aid of a model to point to, it has been fully and well done, in the opinion delivered by the learned Judge who decided this case in the Circuit Court. All that we think it useful or necessary to say is, that after a careful examination of the patents, we think the objection on this ground is not tenable. The force of the objection is mainly directed upon the receiving magnet, which, it is said, is a part of the machinery of the first patent, and performs the same office. But the receiving magnet is not of itself claimed as a new invention. It is claimed as a part of a new combination or arrangement to produce a new result. And this combination does produce a new and useful result. For by this new combination, and the arrangement and position of the receiving magnet, the local independent circuit is opened by the electric or galvanic current as it passes on the main line, without interrupting it in its course, and the intelligence it conveys is recorded almost at the same moment at the end of the line of the Telegragh and at the different local offices on its way. And it hardly needs a model or a minute examination of the machinery to be satisfied that a Telegraph which prints the intelligence it conveys, at different places, by means of the current as it passes along on the main line, must necessarily require a different combination and arrangement of powers from the one that prints only at the end. The elements which compose it may all have been used in the former invention, but it is evident that their arrangement and combination must be different to produce this new effect. The new patent for the local circuits was, therefore, properly granted, and we perceive no well-founded objection to the specification or claim contained in the reissued patent of 1848.

The two reissued patents of 1848, being both valid, with the exception of the 8th claim in the first, the only remaining question is, whether they, or either of them, have been infringed by the defendants.

The same difficulty arises in this part of the case which we have already stated in speaking of the specification and claims in the patent for

the local circuits. It is difficult to convey a clear idea of the similitude or differences in the two Telegraphs to any one not familiarly acquainted with the machinery of both. The Court must content itself, therefore, with general terms, referring to the patents themselves for a more special description of the matters in controversy.

It is a well-settled principle of law, that the mere change in the form of the machinery (unless a particular form is specified as the means by which the effect described is produced), or an alteration in some of its unessential parts, or in the use of known equivalent powers, not varying essentially the machine, or its mode of operation or organization, will not make the new machine a new invention. It may be an improvement upon the former, but that will not justify its use without the consent of the first patentee.

The Columbian (O'Rielly's) Telegraph does not profess to accomplish a new purpose or produce a new result. Its object and effect is to communicate intelligence at a distance, at the end of the main line and at the local circuits on its way. And this is done by means of signs or letters impressed on paper or other material. The object and purpose of the Telegraph is the same with that of Professor Morse.

Does he use the same means? Substantially, we think he does, both upon the main line and in the local circuits. He uses upon the main line the combination of two or more galvanic or electric circuits, with independent batteries, for the purpose of obviating the diminished force of the galvanic current, and in a manner varying very little in form from the invention of Professor Morse. And, indeed, the same may be said of the entire combination set forth in the patentee's third claim. For O'Rielly's can hardly be said to differ substantially and essentially from it. He uses the combination which composes the Register, with no material change in the arrangement, or in the elements of which it consists; and with the aid of these means he conveys intelligence, by impressing marks or signs upon paper; these marks or signs being capable of being read and understood by means of an alphabet, or signs adapted to the purpose. And as regards the second patent of Professor Morse, for the local circuits, the mutator of the defendant does not vary from it in any essential particular. All of the efficient elements of the combination are retained, or their places supplied by well-known equivalents. Its organization is essentially the same.

Neither is the substitution of marks and signs differing from those invented by Professor Morse any defence to this action. His patent is not for the invention of a new alphabet, but for a combination of powers composed of tangible and intangible elements, described in his specification, by means of which marks or signs may be impressed upon paper at a distance, which can there be read and understood. And if any marks, or signs, or letters are impressed in that manner, by means of a process substantially the same with his invention, or with any particular part of it covered by his patent, and those marks or signs can be read, and thus communicate intelligence, it is an infringement of his patent. The variation in the character of the marks would not protect it, if the marks could be read and understood.

We deem it unnecessary to pursue further the comparison between the machinery of the patents. The invasion of the plaintiff's rights, already stated, authorized the injunction granted by the Circuit Court, and so much of its decree must be affirmed. But for the reasons hereinbefore assigned, the complainants are not entitled to costs, and that portion of the decree must be reversed, and a decree passed by this Court, directing each party to pay his own costs in this and in the Circuit Court.

(To be continued.)

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

The U. S. Steamship-of-War Princeton, (2d.) By B. F. Isherwood, Chief Eng., U. S. N.

After the breaking up of the first *Princeton*, it was determined by the Navy Department to build another vessel of larger size, to be called by the same name, and to be propelled by the same engine, but with new boilers and a new screw. This second *Princeton* was constructed at the Charlestown, Mass., Navy Yard in 1851, and had the following dimensions of hull, machinery, &c.

Hull—		
Length on deck,		178 feet.
Length of the mean load line from forward side of rabbet of stem to aft side of rabbet of post, at a mean draft of 19 feet 2 inches from the bottom of the keel,		175·7 feet.
Length of keel,		171 "
Extreme breadth,		32·88 "
" " at deck		32 "
Beam moulded,		32 "
Depth of keel forward,		1 foot 8 inches.
" " aft,		3 feet 10 "
" hold,		21 " 9 "
Height between berth and spar decks,		6 " 6 "
Deep load draft, with 500,000 pounds of coal on board, and all weights full,	forward,	18 "
	mean,	19 " 11 "
	aft,	21 " 10 "
Displacement at 19 feet 11 inches draft,		1485 tons.
" per inch of draft at 19 feet 11 inches draft,		10·93 "
Greatest immersed transverse section at 19 ft. 11 inches draft,		411 sq. feet.
With *one-third* the water, stores, provisions, fuel, &c., expended, the mean draft from bottom of keel is,		19 feet 2 inches.
At 19 feet 2 inches mean draft, the depth from water line to lower edge of rabbet of keel, is		16 " 5 "
Displacement, at 19 feet 2 inches mean draft,		1385 tons.
" per inch of draft, at 19 ft. 2 inches mean draft,		10·87 "
Greatest immersed transverse section, at 19 ft. 2 in. " "		387 sq. feet.
Displacement, exclusive of keel, at 19 ft. 2 in. mean draft,		48381 cub. feet.
Area of the load line, at 19 feet 2 inches mean draft,		4556·5 sq. feet.
Angle of clearance of mean load line, (19 ft. 2 inches mean draft,)		64°
Mean angle of clearance for the whole draft,		26°
Angle of entrance of mean load line,		57°
Mean angle of entrance for the whole draft,		34°
Angle of dead rise of the greatest transverse section,		22°

Area of mean load line in proportion to its circumscribing parallelogram, ...	0·784.
Displacement in proportion to circumscribing parallelopipedon (19 feet 2 inches draft,) . . .	0·524.
Displacement in proportion to cylinder, having for base the greatest immersed transverse section, (19 feet 2 inches,)	0·712.
Area of greatest immersed transverse section in proportion to circumscribing parallelogram, (19 feet 2 inches draft,)	0·737.
Height of meta centre above centre of displacement,	6 feet 8 inches.
Centre of gravity of displacement before middle of the length of the load line, . . .	4 " 4 "
Centre of gravity of displacement below the mean load line,	6 " 3 "
Distance of the greatest immersed transverse section before the middle of the length of the mean load line, .	8 " 3 "
Centre of gravity of area of greatest immersed transverse section below the mean load line, . .	6 " 5 "
Area of immersed surface, exclusive of keel, .	7370 sq. feet.
" surface on side and bottom of keel, .	1130 " "

Sails—(Full rigged ship.)

Surface of courses, topsails, topgallant sails, jib, and spanker,	13282 sq. feet.
Centre of effort before the centre of displacement, .	3 feet 6 inches.
Height of the centre of effort above mean load line,	55 " 6 "
Surface of sail in proportion to area of mean load line,	2·91 to 1·00.
" " " " greatest immersed transverse section,	34·32 to 1·00.
Square feet of surface of sail in proportion to tons of displacement, . . .	9·59 to 1·00.

Engines.—Two semi-cylindrical, direct acting, condensing engines, Ericsson's patent, with rectangular pistons vibrating through an arc of 90°. The engines are attached directly to the screw shaft, which makes one revolution for each double stroke of pistons. The steam valve is the same three-ported slide which was used in the first *Princeton*, but the cut-off valve is a "balance puppet," worked by Sickels' arrangement; this was substituted in place of the old *fixed* slide cut-off, with a view to have the rate of expansion adjustable at will.

Each semi-cylindrical cylinder is equivalent to a common cylinder, with a diameter of . .	57½ inches.
And a stroke of piston of . .	3 feet.
Space displacement of both pistons per stroke, .	108·19 cubic feet.
Steam space between steam slide valves and pistons at *one* end of *both* cylinders, . . .	10·36 " "
Steam space between steam slide and cut-off valves at one end of both cylinders, . .	3·00 " "

Screw.—One of bronze, placed in the stern of the vessel, between the stern-post and rudder-post. The propeller is a true screw radially, with an expanding pitch fore and aft. It makes one revolution for each double stroke of engines' pistons.

Diameter of screw, . .	16 feet.	
" hub, . . .		28 inches.
Initial pitch, . . .	25 "	
Final " . . .	31 "	
Mean " (from which the slip is calculated,) .	28 "	
Length of screw on hub in direction of axis, .	2 "	
Tapering to a length of screw at periphery in direction of axis,	3 "	6 inches.
Number of blades, . 4.		
Mean fraction used of the pitch, . .	0·4265.	

Helicoidal area of the four blades,	115·44 square feet.
Projected area of the four blades on a plane at right angles to axis,	83·88 " "
Distance of the centre of the screw below the surface of the water at 19 feet 2 inches mean draft,	11 feet.
Finished weight of the screw,	15880 pounds.

Boilers.—Three iron tubular boilers, placed side by side, with one smoke chimney in common. The furnaces are arranged in two tiers, one above the other, with the tubes continued in a direct line beyond them. Opposite each furnace in the side boilers there are 23 tubes of $3\frac{1}{2}$ inches external diameter, 18 tubes of 3 inches external diameter, and 1 tube of $2\frac{1}{2}$ inches external diameter. Opposite each furnace of the middle boiler, there are 27 tubes of $3\frac{1}{2}$ inches external diameter, 19 tubes of 3 inches external diameter, and 2 tubes of $2\frac{1}{2}$ inches external diameter. All the tubes are 9 feet long, and contain in the aggregate 3757 square feet of heating surface.

Length of the boilers,	24 feet 5 inches.
Height of the boilers, (exclusive of steam chimney,)	9 " 8 "
Breadth of each side boiler,	7 "
Breadth of the middle boiler,	7 " 10 "
Area of the total grate surface in the three boilers,	213·7 square feet.
" " " heating surface " "	5130 " "
Aggregate cross area over the bridge walls,	18·000 " "
" " " of the tubes,	29·111 " "
" " of the space between the bottom of the hanging bridge and the bottom of the boiler,	21·680 " "
Cross area of the smoke chimney,	37·122 " "
Height of the smoke chimney above grates,	51 feet.
Steam room in the three boilers,	580 cubic feet.
" " " and steam pipes,	678 " "
Weight of sea water in the boilers,	121,700 pounds.

Proportions.—

Proportion of heating to grate surface,	24·006 to 1·000.
" grate to area over bridge walls,	11·872 "
" grate surface to area of tubes,	7·341 "
" grate to area under hanging bridge,	9·857 "
" grate to area of smoke chimney,	5·757 "
Steam room in boilers and steam pipes per cubic foot of space displacement of piston per stroke,	6·27 cubic feet.
Steam room in boilers and steam pipes per cubic foot of steam used per stroke of pistons,	12·365 " "

Performance.—The following tables contain the performance of the *Princeton* (2*d*), as given by the log, and embraces *all* the steaming on the Coasts of Maine and Nova Scotia recorded. The performance is divided into two portions—that under steam alone being contained in one table, and that under steam and sail being contained in another. In the latter there frequently occurs what is termed negative slip of the screw, which is indicated by the minus (—) sign, showing what per centum of its own speed was the speed of the screw *less* than the speed of the vessel, the vessel in these cases being urged forward by a power independent of and additional to the screw. This negative slip never occurs with the vessel propelled by the screw alone.

With the Sickles cut-off, (subsequently removed,) it was found impossible to cut off, with the ordinary velocity of piston, at less than 0·40 of the stroke from the commencement; this was the minimum, and the cal-

culation of the evaporation of the boilers has been made for this point. The position of the throttle was such as to render it of scarcely any use, as it was situated in the steam pipe so far distant from the cylinder valves, that the section of pipe between contained one charge of steam when cutting off at 0·40 the stroke. The evaporation has been calculated for the temperature of feed water 100° F., and for the loss by "blowing off" sufficiently to maintain the sea water in the boiler at twice the natural concentration. Regnault's determination of the latent heat of steam is used. The fuel consumed was principally the Nova Scotia bituminous coal from the Pictou mines, with some mixture of anthracite. The remaining details will be found in the following tables:

Performance of the U. S. Steamship Princeton, (2d,) under Steam unassisted by Sail.

DATE. 1853.	Consecutive hours.	Speed of the vessel per hour, in knots of 6082⅔ feet.	Course of the Vessel.	WIND. Direction.	WIND. Kind.	State of the Sea.	Slip of the screw in per centums of its speed.	ENGINES. Steam press. in boilers in lbs pr sq. in. ab. atm.	ENGINES. Revolutions made by the screw per min.	ENGINES. Pounds of coal consumed per hour.
July 24	5	6·800	N. E.	S. or on quarter.	Light breeze.	Sm'th.	16·26	16·4	29·40	1586
" 28	6	7·375	E.	E. or ahead.	"	"	8·72	15·7	29·25	1925
" 29	8	6·400	—	On bow.	"	"	3·45	9·7	24·00	2741
Aug. 3	16	7·383	S.	S. W. or on bow.	"	"	10·33	15·6	29·81	2397
" 4	17	7·235	—	On quarter.	"	"	8·76	13·0	28·71	2264
" 16	2	7·250	E. S. E.	S.W. or ab'ft bm.	"	"	7·90	16·5	28·50	1576
" 17	9	6·990	E.	W. or aft.	"	"	8·80	14·8	27·75	1769
					WIND.					
" 20	5	6·350	N. W.	N. W. or ahead.	Moderate	Mod'ate	22·59	21·8	29·70	2072
" 24	6	7·083	N. N. W.	E. or abaft beam.	Light	Smooth.	14·51	19·5	30·00	2322
" 29	3	6·167	S. E.	S. S. E. or ahead.	Moderate	Mod'ate	23·88	15·7	29·33	1657
" 29	6	6·400	—	Abaft the beam.	"	Smooth.	3·45	11·0	24·00	1178
" 30	4	5·062	N. W.	W. or on bow.	"	"	8·36	8·1	20·00	1383
Sep. 1	18	6·360	N. N. W.	N. or on bow.	Fresh.	Mod'ate.	13·65	14·6	26·17	1870
" 2	12	6·104	—	Ahead.	"	"	13·90	14·6	25·67	1890
" 3	17	5·386	S. S. E.	S. or ahead.	Strong.	Rough.	27·13	16·2	26·76	2238
" 11	16	4·700	N. W.	N. W. or ahead.	"	H'vy hd.	29·27	17·4	23·22	1970
" 12	24	5·808	N. N. W.	" "	Fresh.	Mod'ate.	14·90	19·4	24·71	2037
" 17	12	7·500	W. S. W.	S. W. or ahead.	Light.	Smooth.	3·02	19·1	28·00	2151
" 23	2	6·250	N. W.	N. by W. or ahead.	Moderate	"	3·70	15·0	23·50	2205
" 24	12	5·880	N. W.	N. W. or ahead.	"	"	7·44	14·5	23·00	1943
Means,		6·331					13·24	15·9	26·42	2026

Performance of the U. S. Steamship Princeton, (2d,) under Steam assisted by Sail.

DATE. 1853.	Consecutive hours.	Speed of the vessel per hour, in knots of 6082⅔ feet.	Sail set.	Course of the vessel.	WIND. Direction.	WIND. Kind.	State of the Sea.	Slip of the screw in per centums of its speed.	ENGINES. Steam press. in boilers in lbs pr sq in. ab. atm.	ENGINES. Revolutions made by the screw per min.	ENGINES. Pounds of coal consumed per hour.
July 28	11	6·863	*	E.N.E.	S. W. or aft.	Light breeze.	Sm'th.	—2·93	13·3	28·54	1734
Aug 17	3	8·183	†	N. E.	WS.W. or aft.	Fresh breeze.	"	—3·34	14·2	28·67	1285
" 17	4	8·687	†	E.by N.	S. W. or aft.	"	"	—14·38	13·0	27·50	1455
Sep. 11	3	8·500	‡	S. W.	N. or on quar.	"	Heavy.	—9·91	12·0	28·00	1376
" 13	3	6·920	§	—	Abeam.	"	Mod'ate.	+6·04	17·3	26·67	2053
" 13	8	7·562	†	N. E.	W. or on quar.	Light breeze.	Sm'th.	—3·32	16·4	26·50	1927
" 18	15	8·467	*	W by S.	S. or abeam.	Strong wind.	Mod'ate.	—7·40	19·5	28·54	2200
" 22	6	6·317	*	S. by E.	E. or abeam.	Light breeze.	Smooth.	+11·46	18·2	25·83	2338
" 23	12	7·271	*	"	N. E. or on qr.	Moderate breeze.	Mod'ate.	—2·56	13·6	25·67	1990
" 23	10	7·386	*	—	On quarter.	"	Sm'th.	—1·68	15·5	26·30	2184
Means,		7·567						+0·26	15·7	27·47	1963

* All sail. † Studding sail. ‡ To topsails. § Fore and aft.

Condition of the Engines, &c.—During the steaming recorded in the foregoing tables, the metallic packings of the vibrating pistons of the engines were in a very bad condition, leaking steam freely. It appears from a late overhauling of the engines at New York, that the packing on the top of the pistons, comprising about one-third of their periphery, had not only never been tight, but had always had a *clear space* between the metallic packing bar and the cylinder. This of course operated not only a great loss of steam, but it also decreased the power of the engines by a portion of the steam passing continually from the steam side of the pistons to the condensers. One of the vibrating pistons was also found loose on its shaft. The calculated evaporation in the following "Summary," does not include this loss, which of course could only be estimated. That calculation is made from the number of cylinders full of steam used; the real evaporation would necessarily be higher, probably about a quarter pound of steam per pound of coal; as I find the boilers of the *Allegheny*, precisely like the *Princeton's*, and of the same size, evaporated under the same conditions 6·516 pounds of steam per pound of coal. The *Princeton's* and *Allegheny's* boilers consumed the same weight of coal per hour, and as the temperature of the smoke pipe of the latter, within the steam pipe or drum that surrounded it, was 450° Fah., it may be concluded that the temperature of the *Princeton's* was the same.

The same kind of boiler as the *Princeton's* is in present use in a number of British war-steamers; it was originally introduced into the United States for steamers by Robert L. Stevens, of Hoboken, N. J., who put it, in 1837, in the Steamboat *Independence*, plying between South Amboy,

N. J., and New York. This boiler burned anthracite with a fan blast; it was of copper, and made by R. H. Dunham & Co., of New York; it gave general satisfaction. By referring back to the evaporation given by the boilers of various steamers recorded in the pages of this Journal, it will be seen that, with the exception of the boilers of the Collins Steamers, the *Princeton's* boiler gave a full average evaporation per pound of coal.

The stuffing boxes of the engine piston shafts leaked so badly as greatly to impair the vacuum, which could not be maintained at an average of more than 22 inches of mercury in the condenser, giving a very great back pressure on the piston.

Summary of the Performance of the U. S. Steamship Princeton, (2d,) from July 24, to September 24, 1853, on the Coasts of Maine and Nova Scotia, embracing all the steaming recorded in the Logs.

	Under steam unassist'd by sail.	Under steam assisted by sail.	Mean of total steaming with and without sail.
OBSERVED.			
Total number of hours,	200	75	275
Speed of the vessel per hour in knots of 6082⅔ feet,	6·331	7·567	6·668
Steam pressure in boilers in lbs. per sq. in. above atmos.,	15·9	15·7	15·85
Steam pressure in cylinders in lbs. per sq. in. above atm.,	12	10	11·46
Double strokes of pistons (and revolutions of the screw) per minute,	26·42	27·47	26·71
Steam cut off at from commencement of stroke of pistons,	0·40	0·40	0·40
Back pressure in condensers in lbs. per square inch,	2.7	2·7	2·7
Pounds of coal burned per hour,	2026	1963	2009
Tons of coal burned per 24 hours,	21·70	21·03	21·52
Mean draft of vessel in feet and inches,	19 6	19 6	19 6
Immersion of centre of screw below surface of water in feet and inches,	11 4	11 4	11 4
Greatest immersed transverse area in square feet,	397	397	397
Displacement of the hull in tons,	1428	1428	1428
State of the sea,	Moderate.	Moder'ly smooth.	—
State of the wind,	Moderate on bow.	Moder'ly fresh on quarter.	—
CALCULATED.			
Slip of the screw in per centums of its speed,	13·24	0·26	9·61
Mean effective pressure on pistons in lbs. per sq. inch,	13·8	12·2	13·37
Horses power developed by the engines,	344·27	316·45	337·21
Pounds of coal burned per hour per square foot of grate surface,	9·481	9·186	9·401
Pounds of coal burned per hour per square foot of heating surface,	0·395	0·383	0·392
Cubic feet of steam of atmospheric pressure furnished per minute from sea water of twice the natural concentration, with temperature of feed water 100° Fahr., inclusive of loss by blowing off to maintain that concentration, and of loss between valves and pistons, and in steam ports,	—	—	5690·92
Pounds of steam evaporated per hour from one square foot of heating surface, under the above conditions,	—	—	2·447
Pounds of steam evaporated per hour by one pound of coal, under the above conditions,	—	—	6·248

The following figures will show a tolerably correct idea of the relative proportions of the vessels. The engines were the same in both.

Comparison between the First and Second Princetons.

	First Princeton.	Second Princeton.
HULL.		
Mean draft of the vessel from the bottom of the keel, with *one-third* the fuel, water, provisions, &c., expended,	16 ft. 1½ in.	19 ft. 2 ins.
Depth of the hull from the above water line to lower edge of rabbet of keel, ...	14 "	16 " 5 "
Displacement at above draft, ...	954 tons.	1385 tons.
Weight of the hull, ...	418 "	650 "
Displacement per inch of draft at above draft, . .	9·17 "	10·87 "
Length of the hull on above water line, ...	153 ft. 8½ in.	175·7 feet.
Extreme breath of hull on water line, ...	30 "	32·88 "
Greatest immersed transverse section at above draft,	338 sq. feet.	387 sq. feet.
Area of the load line at above draft, ...	3740·8 "	4556·5 "
Height of meta centre above centre of displacement,	7 feet.	6 ft. 8 in.
Centre of gravity of displacement before the middle of the length of the load line, ...	3 ft. 11½ in.	4 " 4 "
Centre of gravity of displacement below the mean load line,	5 " 4½ "	6 " 3 "
Distance of the greatest immersed transverse section before the middle of the length of the mean load line, .	7 " 1¾ "	8 " 3 "
Centre of gravity of area of greatest immersed transverse section below the mean load line, ...	8 " 1¼ "	6 " 5 "
Angle of dead rise for the greatest transverse section,	13°	22°
Angle of entrance of mean load line, . . .	80°	57°
Mean angle of entrance for the whole draft, .	36°	34°
Angle of clearance of mean load line, ...	78°	64°
Mean angle of clearance for the whole draft, .	43°	26°
Displacement in proportion to circumscribing parallelopipedon, ...	0·525	0·524
Displacement in proportion to cylinder, having for base the greatest immersed transverse section, . .	0·634	0·712
Area of greatest immersed transverse section in proportion to circumscribing parallelogram, ...	0·804	0·737
Area of mean load line in proportion to circumscribing parallelogram, ...	0·811	0·784
Total immersed surface of hull in square feet, . .	6820	8500
SCREW.		
Diameter, ...	14·25 feet.	16 feet.
Pitch, ...	32·44 "	28 "
Kind of pitch, ...	Regular.	Expanding fore & aft from 25 to 31 feet.
Number of blades, ...	6	4
Area of helicoidal surface, ...	176·71 sq. ft.	115·44 sq. ft.
Area of projected surface on a plane at right angles to axis,	113·52 "	83·88 "
BOILERS.		
Aggregate breadth, ...	21 feet.	21 ft. 10 in.
Length, ...	26 "	24 " 5 "
Height, exclusive of steam chimney, ...	9 ft. 4 ins.	9 " 8 "

Performance of the Princeton (2d,) in smooth water, uninfluenced by wind.—The following performance is what can be steadily sustained in the smooth water of a Bay, uninfluenced by wind, and was determined

from runs in Chesapeake Bay, where the distances were accurately known. The vessel being at a mean draft of $19\frac{1}{2}$ feet.

Speed of the vessel per hour in knots of $6082\frac{2}{3}$ feet, .	8·037.
Double strokes of engine pistons (and revolutions of screw) per minute,	30.
Mean effective pressure on pistons in pounds per square inch,	17.
Horses power developed by the engines, .	481·57.
Slip of the screw (calculated for mean pitch of 28 feet) in per centums of its speed, . . .	3.

If, for this performance, the friction of the engines, *per se*, be taken at 1·25 pounds per square inch when making 30 double strokes, which, from experiments on other engines, I believe to be very near the truth, the co-efficient for the friction of the load at $7\frac{1}{2}$ per cent. according to Morin's determination, and the friction on the screw surface on the water be taken the same as determined from the screw of the "Charlemagne" in the February number of this Journal, viz.: at 0·7796 pound per square foot of helical surface, moving in its helical path with a velocity of 10 feet per second, we shall obtain the following disposition of the power:

	H. Power.		Per Cent.
Expended in overcoming friction, &c., of the engines,	35·41	or	7·35
" " " of the load, .	36·12		7·50
" " " of the screw surface, &c., on the water,	39·23		8·15
" in the slip of the screw, . .	11·13		2·31
" in propelling the simple hull, .	359·68		74·69
Total, . . .	481·57		100·00

From the above, we find that (74·69+2·31=) 77 per centum of the total power was applied to the screw, and 77 per centum of the mean effective pressure, 17 pounds, is 13·09 pounds per square inch of piston. The area of the two pistons is 5193·44 square inches, and the double stroke of pistons is 6 feet; the thrust of the screw will therefore be

$$\frac{5193{\cdot}44\times13{\cdot}09\times6}{28}=14568 \text{ pounds.}$$

During the above performance, the anterior edge of the screw (25 feet pitch) had a *negative* slip of 8·64 per centum, but the posterior edge (31 feet pitch) had a *positive* slip of 12·39 per centum, showing, that with the pitch properly expanded in the fore and aft direction of the screw, the posterior portion of the screw blade can be made to act proportionally in a very efficient manner. It may be supposed, as some of the anterior portion of the blade (one-sixth of the whole blade) had a less speed than the vessel, and carried a sea before it, that the carrying of this sea caused a waste of power; such, however, is not the case; for as pressure and resistance are equal and in opposite directions, whatever power was bestowed on the water carried in front of the screw, the same was regained by the resistance of this water acting in the direction of turning the screw propulsively. The screw, however, was intended for ocean navigation, where with a moderate sea and a moderate wind on the bow, it gave the following results, viz:

Performance of the Princeton 2d at sea without sail.

Speed of the vessel per hour in knots of $6082\frac{2}{3}$ feet, .	6·331.
Double strokes of engine pistons (and revolutions of the screw) per min.	26·42.
Mean effective pressure on pistons in pounds, per sq. inch. .	13·8.

Horses power developed by the engines, .	344·27.
Slip of the screw (calculated for its mean pitch of 28 feet) in per centums of its speed, . . .	13·24.

Proceeding as before, we obtain the following disposition of the power, viz.:

	H. Power.		Per Cent.
Expended in overcoming the friction, &c. of the engines,	27·47	or	7·98
" " " of the load,	25·82		7·50
" " " of screw surface, &c., on the water,	26·80		7·79
" in the slip of the screw, . .	34·98		10·16
" in propelling the simple hull, .	229·20		60·77
Total, . . .	344·27		100·00

From the above, we find that (60·77+10·16=) 70·93 per centum of the total power was applied to the screw, and 70·93 per centum of the mean effective pressure, 13·8 pounds, is 9·79 pounds per square inch of pistons. Proceeding as before, we have, then, for the thrust of the screw $\left(\frac{5193{\cdot}44 \times 9{\cdot}79 \times 6{\cdot}}{28}=\right)$ 10895 pounds.

Increased resistance of the vessel from a moderate head sea and wind, over the resistance in smooth water, uninfluenced by wind.—The power required to drive the vessel in smooth water, uninfluenced by wind, at the speed of 8·037 knots per hour, was 359·68 horses power, which for the speed of 6·331 knots per hour, would become ($8{\cdot}037^3 : 359{\cdot}68 :: 6{\cdot}331^3 :$) 175·79 horses. For this speed of 6·331 knots per hour against a moderate head sea and wind, we have seen that a power of 359·68 horses was required; the resistance of the hull has, therefore, been increased $\left(\frac{359{\cdot}68}{175{\cdot}79}=\right)$ 2·044 times.

Comparison of the Performances of Princetons 1st and 2d, at sea, without sail, and against moderate head seas and wind.—The most satisfactory comparison of the performances of these vessels, will doubtless be at sea under the ordinary condition of things found there when steaming alone; and for that purpose there will be selected the performance of *Princeton* 1*st*, with Stevens' screw, for the whole period during which she was commanded by Captain Engle, and under the above conditions of weather. The results thus obtained, being the mean of many thousand observations, noted by different watch officers in the ship's official log, can doubtless be depended on, and are as accurate as such results can ever be determined. The abstract of these logs can be found on page 107 of the August number, 1853, of this *Journal*. The mean results for 1099 hours steaming in the Gulf of Mexico, the Mediterranean, and Atlantic Ocean, are as follows, viz:

Speed of the vessel per hour in knots of 6082⅔ feet, .	6·172.
Double strokes of engine pistons (and revolutions of screw) per minute,	24·064.
Mean effective pressure on pistons in pounds, per sq. inch, .	10·47.
Horses power developed by the engines, .	237·9.
Slip of the screw in per centums of speed, . .	19·85.

Proceeding as in the former cases, we obtain the following disposition of the power, viz:

		H. Power.		Per Cent.
Expended in overcoming the friction, &c.,	of the engines,	21·62	or	9·09
" " "	of the load,	17·84		7·50
" " "	of screw surface on the water,	30·20		12·69
" in the slip of the screw,		33·40		14·04
" in propelling the simple hull,		134·84		56·68
Total,		237·90		100·00

From the above, we find that $(56{\cdot}68 + 14{\cdot}04 =)$ 70·72 per centum of the total power was applied to the screw, and 70·72 per centum of the mean effective pressure, 10·47 pounds, is 7·404 pounds per square inch of pistons. Proceeding as before, we have for the thrust of the screw, $\left(\frac{5193{\cdot}44 \times 7{\cdot}404 \times 6.}{32{\cdot}44} = \right)$ 7112 pounds.

With the *Princeton 2d*, there was required to propel the simple vessel against moderate head seas and winds, at the rate of 6·331 knots per hour, 229·20 horses power, for the speed of 6·172 knots per hour; this would become $(6{\cdot}331^3 : 229{\cdot}20 :: 6{\cdot}172^3 :)$ 212·34 horses power; and as the *Princeton* 1*st* required only 134·84 horses power for the same speed, under the same conditions, it follows that the resistance of the *Princeton* 2*d* was $\left(\frac{212{\cdot}34}{134{\cdot}84} = \right)$ 1·575 times greater than that of the *Princeton* 1*st*.

For the Journal of the Franklin Institute.

The "Iron Ridge" and Ore Beds of Dodge County, Wisconsin. Condensed from Dr. Owen's Geological Survey of Wisconsin, &c. By Dr. L. Turnbull.

(Continued from page 270.)

During the last three years, these deposits have attracted much notice, partly on account of the interesting and anomalous character of the ore, and partly because of the great practical value of a bed thus situated. "The Wisconsin Iron Company" has the credit of making the first experiment upon this ore; and, in fact, of erecting the first, and at present the only stack furnace in Wisconsin. The same enterprising gentlemen, who were the pioneers in iron manufacture in the State of Indiana, where they erected the "Mishawaukie Furnace," upon the bog ores near the Michigan line, have directed their skill, capital, and energy, to the same interest in the State of Wisconsin. Their works at Maysville, in Dodge county, are driven by water, and consume the ore of the "Iron Ridge," which is hauled on sleds in winter, about four and a half miles. The geological position of this ore has not been determined with precision. Mr. Lapham, of Milwaukie, has traced the formations to the eastward of the boundaries of Dr. Owen's survey of 1839, in places as far as Lake Michigan; but the fossils are so few, and so much of the surface of the country mantled by deposits of drift, concealing the rocks, and the limestones possessing lithological or external characters so little marked and so little diverse at distant points, and their stratification so poorly

defined, that it is very difficult to form a good opinion of the order of the strata.

According to Mr. Lapham, of Milwaukie, the lower sandstone formation extends into Dodge County, at the north-west corner and south-west corner; and the "Lower magnesian limestone" is seen through the western part of the country resting upon this sandstone. Fig. 1.

In the south-west part of the country, the "Blue limestone" is clearly developed. After passing an interval of four or five miles to the eastward of the latter formation, the "Upper magnesian" or lead-bearing limestone is visible, having a breadth of about six miles; the eastern observed limit being six miles to the west of Rock River, on the south line of the country. These rocks all dip easterly.

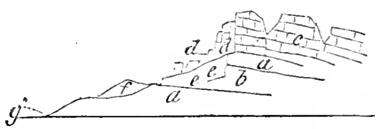
Passing now over to the lake-shore near Milwaukie, Mr. Lapham found the succession of rocks taken in the reverse order as follows:

1. Corniferous limestone.
2. Geodiferous lime-rock of Eaton.
3. Next beneath the geodiferous, is a heavy bed of limestone, which Mr. Lapham calls, as a temporary name, the "Waukeshaw Limestone."

The Waukeshaw limestone, like the geodiferous and the corniferous, which overlie it, dips to the east. It appears in the south-east part of Dodge County, leaving an undetermined space between its western outcrop and the eastern presentation of the upper magnesian or lead-bearing lime-rock of about two townships or twelve miles. It is in this interval, but doubtless in the same formation, that the iron ore occurs. It appears in the face of a bluff, looking westward, and running nearly north and south, parallel with that portion of Rock River, between Horicon and Hustisville, and about four miles east of the river.

It exists on the surface in small *flattened oblong grains*, like flaxseed, but only about half as large, with a bright brownish red color, inclining in streaks to black or bluish black, with an unctuous, greasy, magnesian feel; soils the fingers and clothes badly, and gives a light blood-red tinge to water flowing through it when newly dug. Earther down in the mass, where it has not been disturbed by deluvial forces, it is darker in color, more compact, distinctly stratified, and occasionally stony. The following section of the "Iron Ridge," was taken at Mr. Theodore B. Sterling's steam saw-mill, Section 13, T. 11 North Range, 16° east of 4th Principal Meridian, the course being east and west:

70 Feet.



c, Bluff of cavernous limestone, from which springs issue.
aa, Hidden from view.
b, Exposed stratified ore.
ee, Excavation.
dd, Large blocks of limestone.
f, Material removed.
g, Coarse drift.

The base of this section is the spring, at the spring-house, a few rods

east of Mr. Sterling's dwelling-house, which Mr. S. estimates at thirty feet above the surface of the dam at Hustisville, which is two hundred and ninety-five feet above Lake Michigan. The elevation of the spring above the river is probably greater than is here given.

An excavation, *e e*, has been made through the rubbish of the bluff to the ore in place, where a face of fifteen and a half feet is exposed.

It was not practicable by inspection to determine the limit of the ore below the bottom of the cut *e e*, although an iron bar had been thrust down four or five feet without reaching any other deposit. On the upper face, judging from the shattered and tumbling state of the overlaying lime-rock, there should be from five to eight feet of ore, or some soft stratum above the exposed portion. If this conjecture be true, there are at least twenty-five feet of the ore in place.

Passing along the bluff to the southward, it inclines to the east, and shows red ochre for more than half a mile, in some places on the same level, at others higher up the hill, especially where it takes a more regular slope and the cliff is not seen. From the crest of the bluff, at the section, the level descends to the eastward, and ochre covers the lime-rock like soil or deluvium. To the northward, the same appearances are observed, and at about three-quarters of a mile, where the Wisconsin Iron Company take out their ore, the hill appears to be all ore for sixty feet in height. The surface ore is here mined almost as readily as sand or loose earth, only stripping the soil and taking out the roots that are intermingled with it. The overlying limestone at Sterling's is a granular grey variegated whitish and yellowish limestone that makes good lime. The analysis of the Sterling ore by Professor J. L. Cassels, of Cleveland, Ohio, indicates over 53 per cent. of iron, which is as follows:

Peroxide of iron,	76·74	{ 53·72 iron. 23·02 oxygen.
Sesquioxide of manganese,	1·05	
Clay,	4·00	
Silex,	10·00	
Water,	6·00	
Loss,	2·21	
	100·00	

The Wisconsin Iron Company, under the management of John Niles, Esq., use the ore without burning, and find it to melt very easy without flux; in fact, it has been found necessary to introduce silex, in the shape of water-washed sand, to retard the process of melting and thus improve the quality of the metal. In November, 1849, their charge consisted of fifty-five pounds of bog ore, sixty-six pounds of sand, thirty-five pounds of limestone, and six hundred and sixty pounds of the ochery ore unburnt. The yield with a moderately hot blast, was thirty-five to forty-two per cent. of iron; the furnace running out three and a half to four tons of metal per day, of twenty-four hours, with a consumption of one hundred and forty-five to one hundred and fifty-five bushels of charcoal per ton. The castings made from this iron are smooth, and the sound and texture of the metal was good, but seemed to be less tough than other castings. The manager was about to try the effect of cold blast on the quality of the iron.

*Process for Printing copies of Plants, Materials, Lace, &c., from the originals, styled ("Naturselbstdruck") Natural Printing Process,**

Under this term, Louis Auer, of the Imperial Printing Office at Vienna, has patented a process invented by himself in conjunction with Mr. Andrew Worring, overseer of the same establishment, "for creating, by means of the original itself, in a swift and simple manner, plates for printing copies of plants, materials, lace, embroideries, originals or copies, containing the most delicate profundities or elevations not to be detected by the human eye," &c. A pamphlet giving a description of this discovery and a series of specimens has reached us. The examples consist of an impression from a fossil fish, from agates, the leaves of trees, several plants, mosses, algæ, and the wing of a bat. These are all printed in the natural color of the objects they represent; and it is difficult to conceive anything more real than these productions. The general character of the process is told in the following pithy manner by Louis Auer, in the introductory paragraphs of his pamphlet:—

"*Query*—How can, in a few seconds, and almost without cost, a plate for printing be obtained from any original, bearing a striking resemblance to it in every particular, without the aid of an engraver, designer, &c.? —*Solution*—If the original be a plant, a flower, or an insect, a texture, or, in short, any lifeless object whatever, it is passed between a copper plate and a lead plate, through two rollers that are closely screwed together. The original, by means of the pressure, leaves its image impressed with all its peculiar delicacies,—with its whole surface, as it were,—on the lead plate. If the colors are applied to this stamped lead plate, as in printing a copperplate, a copy in the most varying colors, bearing a striking resemblance to the original, is obtained by means of *one single* impression of each plate. If a great number of copies are required, which the lead-form, on account of its softness, is not capable of furnishing, it is stereotyped, in case of being printed at a typographical press, or galvanized in case of being worked at a copperplate press, as many times as necessary, and the impressions are taken from the stereotyped or galvanized plate instead of from the lead plate. When a copy of a unique object, which cannot be subjected to pressure, is to be made, the original must be covered with dissolved gutta percha; which form of gutta percha, when removed from the original, is covered with a solution of silver to render it available for a matrix for galvanic multiplication."

This process is also applicable to the purpose of obtaining impressions of fossils, or of the structure of an agate or other stone. In all the varieties of agate, the various layers have different degrees of hardness; therefore, if we take a section of an agate, and expose it to the action of fluoric acid, some parts are corroded, and others not. If ink is at once applied, very beautiful impressions can be at once obtained; but for printing any number, electrotype copies are obtained. These will have precisely the character of an etched plate, and are printed from in the ordinary manner. The silicious portions of fossil and the stone in which they are imbedded may in like manner be acted upon by acid; and from these either stereotyped or electrotyped copies are obtained for printing

* From the London Athenæum, December, 1853.

from. We learn that Mr. Bradbury, of the firm of Bradbury & Evans, has availed himself of this invention, and that he is now preparing a series of Botanical specimens for publication,—so that, very shortly, the public will be in possession of examples of this beautiful process. It is not a little singular that the workers in German silver and Britannia metal, at Birmingham, have for some time been in the habit of ornamenting the surfaces of these metals by placing a piece of lace, no matter how delicate, between two plates, and passing these betwen rollers. In this way every fibre is most faithfully impressed upon the metal. We are not aware, however, that any attempts to print from these impressions have yet been made at Birmingham. The value set on the invention by the author may be judged by the following paragraph:—

"Russia has given up Jacobi's application of the Galvanoplastik in the year 1837, and France the Daguerreotype for general use in the year 1839; Austria has now furnished a worthy pendant to these two inventions."

On the Consumption of Smoke.—Experiments with Jukes's Patent Furnace.
By Mr. A. Fraser.*

The author stated that it was not intended to enter on the various theories which have been advanced on the subject, or to discuss the many inventions before the public, still less to bring forward any new theory, but to give the "results of absolute work," in a successful attempt to remove the smoke nuisance from an extensive London brewery and its neighborhood. Messrs. Truman, Hanbury, Buxton, & Co. had tried most of the plans which previous to 1847 gave reasonable hopes of success. In 1847 the writer's attention was first drawn to Jukes's patent furnace, which consisted of a strong cast-iron frame of the full width of the furnace, and about three feet longer. The fire bars were all connected together, forming, when complete, an endless chain, and were made to revolve round a drum, placed at each end of the frame. The front of the frame was provided with a hopper, in which the fuel was placed, and a furnace door, which opened vertically with a worm and pinion. The height to which this door was raised by the stoker, regulates the supply of coal, which was carried into the fire by the gradual motion of the bars. This plan was first applied to an engine boiler—a cylindrical one, with two tubes—driving a 40-horse power engine; and having been successful, it was adapted to a second boiler of the same kind. In the same year the probability of its success under a brewing copper was discussed. There was no doubt, from the former experiments, as to its capabilities for raising steam or for evaporation; but with a brewing copper provision had to be made for a process in the manufacture almost peculiar to it. The contents of the copper have to be turned out several times in the course of a brewing, rendering it necessary to "bank up" the fire thoroughly, to protect the bottom of the copper, until refilled with wort or water. It was feared that the machinery would interfere with this being done effectually: it was tried, and with the same success as with the steam boilers. The remainder of the coppers and boilers were afterwards altered. The total cost of the

* From the London Athenæum, December, 1853.

fourteen furnaces, including brickwork, had been about 3000*l.* The consumption of coals in the establishment was 6000 tons per annum. The saving in the coal account, since the introduction of the patent to July 1st of the present year, had been 8338*l.*, from which must be deducted for casualties, and sundries, say 350*l.* The above economy had not arisen from less weight of fuel consumed, but owing to the screenings or dust of coal only being required for the furnaces. It would appear at first sight that the wear and tear of a machine, apparently so complicated, must exceed the expense of the common fixed bars. This, however, had not been found to be the case, and it need not be so if ordinary care were given to the machine, and a periodical examination such as any other machine of equal value and producing equally important results would receive. Within the last week a set of bars, which had been in use since May, 1849, had been renewed, for the first time; and three-fourths of the old bars were being again used for another furnace, where the boiler was of less importauce than the one from which they have been removed.

For the Journal of the Franklin Institute.

Particulars of the Steamboat Adelaide.

New York.—Hull built by Lupton & McDiarmid, Greenpoint, L. I. Machinery by Neptune Iron Works. Intended service, San Francisco.

HULL.—		
Length on deck,		245 feet.
Breadth of beam, moulded, at midship section,		33 "
Depth of hold,		9 " 6 inches.
Length of engine and boiler space,		72 "
Draft of water at load line,		5 "
Draft of water at below pressure and revolutions,		5 "
Masts and rig—Foretopsail schooner.		
ENGINE.—One—Vertical beam.		
Diameter of cylinder,		50 inches.
Length of stroke,		12 feet.
Maximum pressure of steam in pounds,	40	
Cut off at half stroke.		
Maximum revolutions per minute,	23	
BOILER.—One—Return flued.		
Length of boiler,		32 feet.
Breadth "		13 " 6 inches.
Height " exclusive of steam chimney,		11 " 8 "
Number of furnaces,	3	
Length of grate bars,		8 "
Number of flues,	10 below, 6 above.	
Internal diameter of flues,	17 inches in upper flues.	
Diameter of smoke pipe,		61 inches.
Height "		28 feet.
WATER WHEELS.—		
Diameter of water wheel,		32 feet.
Length of blades,		8 " 6 inches.
Depth "		24 "
Number "	24	

Remarks.—Guards forward; floor timbers at throats *moulded* 15 inches, *sided* 5 and 6 inches; distance of frames apart *at centres*, 22 inches. Blower to furnace.

For the Journal of the Franklin Institute.

Particulars of the Steamer (Not named.)

New York.—Hull built by Jacob A. Westervelt & Son. Machinery by Morgan Iron Works. Intended service, Pacific.

HULL.—			
Length on deck,		264 feet.	
Breadth of beam moulded,		36 "	
Depth of hold,	17 feet 3 in. and	24 "	6 inches.
Length of engine and boiler space,		66 "	
Draft of water at load line,		9 "	6 "
" " below pressure and revolutions,		9 "	6 "
Contents of bunkers in tons of coal,	550		
Masts and rig—Foretopsail schooner.			
Tonnage, (custom-house),	1653		
ENGINES—Two—vertical beam.			
Diameter of cylinder,			50 inches.
Length of stroke,		10 feet.	
Maximum pressure of steam in pounds,	22		
Cut off at half stroke.			
Maximum revolutions per minute,	18		
BOILERS—Two—single return flued.			
Length of boilers,		30 feet.	
Breadth "		13 "	
Height " exclusive of steam chimney,		12 "	
Number of furnaces	6		
Length of grate bars,		7 "	
Number of flues or tubes,	28		
Internal diameter of flues or tubes,		16, 15, 13, and 10 inches.	
Diameter of smoke pipe,		6 feet	9 "
Height "		42 "	
Description of coal,	Bituminous.		
Consumption of coal per hour,	1 ton.		
PADDLE WHEELS.—			
Diameter of water wheel,		30 feet.	
Length of blades,		9 "	
Depth "			16 inches.
Number "	28		

Remarks.—Guards fore and aft—Hull strapped with diagonal and double laid iron braces, $4\frac{1}{2} \times \frac{5}{8}$. Floor timbers at throats, *moulded*, 16 inches; *sided*, 14. Distance of frames apart *at centres*, 28 inches. Draft of boilers, natural.

Electro-Deposition of Aluminium and Silicium. By GEORGE GORE, Esq.*

Enclosed are two specimens of sheet copper, one coated with metallic aluminium and the other with silicium, by electro-deposition process; and if the following simple statement of the manner in which they were obtained is worthy of a place in your Magazine, I shall be happy to have it published.

To obtain the aluminium, I boiled an excess of dry hydrate of alumina in hydrochloric acid for one hour, then poured off the clear liquid, and added to it about one-sixth of its volume of water; in this mixture I placed an earthen porous vessel containing one measure of sulphuric acid to twelve

*From the Lond., Edinb., and Dublin Philosoph. Magazine, March, 1854.

measures of water, with a piece of amalgamated zinc plate in it. In the chloride of aluminium solution I immersed a piece of copper of the same amount of immersed metallic surface as that of the zinc, and connected it with the zinc by means of a copper wire, and set it aside for several hours; when on examining it, I found it coated with a lead color deposit of aluminium, which when burnished possessed the same degree of whiteness as platinum, and did not appear to tarnish readily by immersion in cold water or in the atmosphere, but was acted upon by sulphuric or nitric acids, either concentrated or dilute.

I found that if the apparatus was kept quite warm, and a copper plate much smaller than the zinc plate was used, the deposit appeared in a very short time, in several instances in less than half a minute. Also I found that if the chloride solution was not diluted with water, the deposit was equally, if not more rapid.

I have also succeeded in obtaining a quick deposit of aluminium in a less pure state by dissolving ordinary "pipe clay" in boiling hydrochloric acid, and using the supernatant clear solution undiluted with water in the place of the before mentioned liquid. A similar deposit of aluminium was also obtained from a strong aqueous solution of acetate of alumina; likewise from a saturated aqueous solution of ordinary "potash alum," but rather slowly; with each of the solutions named, the deposit was hastened by putting either one, two, or three small Smee's batteries in the circuit.

To obtain the deposit of silicium, I dissolved monsilicate of potash (formed by fusing together 1 part of silica with $2\frac{1}{4}$ parts of carbonate of potash) in water, in the proportion of 40 grs. to 1 oz. measure of water, proceeding in like manner as with the alumina solutions, the process being hastened by interposing one pair of small Smee's battery in the circuit. With a very slow and feeble action of the battery, the color of the deposited metal was much whiter than that of the aluminium, closely approximating to that of silver; its other properties I have not yet had time to examine.

8 *Broad Street*, *Birmingham*, *February* 24, 1854.

On Aluminium and its Compounds. By M. Deville.*

It is known that Wöhler obtained the metal aluminium in the state of a powder by treating the chloride with potassium. By a suitable modification of Wöhler's process, the decomposition of the chloride of aluminium can be regulated so as to produce a temperature sufficient for the particles of the metal to agglomerate into globules. If the mass composed of the metal and chloride of sodium (sodium is preferable to potassium) is exposed to a bright red heat in a porcelain crucible, the excess of chloride of aluminium is expelled, and there is left a saline mass with an acid reaction in which are disseminated more or less large globules of perfectly pure aluminium.

This metal is as white as silver, and in the highest degree malleable and ductile. When wrought, however, it exhibits greater resistance, and its tenacity probably approaches that of iron. It is hardened by

* From the London, Edinburgh, and Dublin Philos. Magazine, March, 1854.

hammering, but reacquires its softness on being reheated. Its fusing-point differs but slightly from that of silver; its specific gravity = 2·56; it can be melted and cast without being perceptibly oxidized; it is a good conductor of heat. It is not in the least affected by moist or dry air, does not tarnish, but remains bright by the side of zinc and tin freshly cut, which soon become dull. Sulphuretted hydrogen has no action upon it, cold water does not alter it, boiling water does not tarnish it. It is not acted upon by nitric acid, weak or strong, or by weak sulphuric acid, employed cold. Its true solvent is hydrochloric acid, with which it forms chloride of aluminium. Heated to redness in hydrochloric acid gas it furnishes dry volatile chloride of aluminium.

It will be readily understood what important uses such a metal, which is white and unalterable like silver, which does not blacken in the air, is fusible, malleable, ductile and tenacious, and has in addition the singular property of being lighter than glass, may be turned to if it can be obtained readily. This I have every reason to believe will prove to be the case, for the chloride of aluminium is decomposed with remarkable ease by the common metals at an elevated temperature; and a reaction of this kind, which I am attempting to carry out on a large scale, will solve this question in a practical point of view.—*Comptes Rendus*, Feb. 6th, 1854.

For the Journal of the Franklin Institute.

Particulars of Steamer Cahawba.

New York.—Hull built by William Collyer. Machinery by Allaire Works. Owners, New York and Alabama Steamship Company. Intended service, New York and Mobile, via Havana.

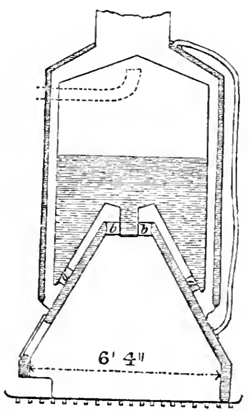
Hull.—		
Length on deck,		260 feet.
Breadth of beam at midship section,		37 "
Depth of hold,		19 " 6 inches.
Length of engine space,		78 "
Draft of water at load line,		17 "
Masts and rig—	Barque.	
Tonnage, (custom-house,)	1713	
Engine.—One—vertical beam.		
Diameter of cylinder,		75 inches.
Length of stroke,		11 feet.
Boilers—Two—return flued.		
Length of boilers,		31 feet 9 inches.
Breadth "		12 " 6 "
Height " exclusive of steam chimney,		11 " 6 "
Number of furnaces in each boiler,	3.	
Length of grate bars,		8 "
Diameter of smoke pipe,		6 " 4 "
Height "		42 "
Description of coal,	Bituminous and Anthracite.	
Water Wheels.—		
Diameter of water wheel,		31 feet.
Length of blades,		8 " 6 inches.
Depth "		16 "
Number of blades,	28.	

Remarks.—Floor timbers at throats, *moulded* 15½ inches; *sided* 14½ inches. Distance of frames apart *at centres*, 29 inches.

For the Journal of the Franklin Institute.

The Bee-Hive Boiler of Lake Erie. By Thomas Drew Stetson.

The steam navigation of the lakes of North America is distinguished by the occasional employment of a form of boiler, locally known by several different appellations, among which the "bee-hive" is, perhaps, the most strikingly descriptive. The accompanying sketch is designed to represent a vertical section through the whole structure, and also through a "water jacket," with which the larger sizes are invariably provided, and which may be considered, in fact, as it certainly is in effect, a part and parcel of the boiler. The boiler proper is in two portions, one above the other, with suitable connexions, to allow a free circulation of the contents. A connexion is made by a copper pipe leading from the topmost point of the jacket to a position near the base of the main shell, down which the full heated water and a small modicum of steam is assumed to be continually flowing. This pipe is the only means of communication. The check-valve, not shown in the sketch, is attached to the jacket near its lower rim, and although the vessels are rarely propelled with independent feed pumps of any description, the arrangement renders it practically certain that this important appendage will remain at all times nearly or quite filled with water. There are four connexions, *a a*, located at equidistant points in the horizontal plane. The connexions, *b b*, are two in number, and serve to convey the current of steam and highly heated water from the lower into the upper shell, while the lower and more liberal passages may be supposed, in some cases at least, to convey a current in opposite direction. It may be sufficient to know, however, that the deposit, in all cases, settles to the bottom of the lower shell, at which point, as well as at the lower edge of each of the outer portions, ample provision is made for its removal. In the fresh clear water of the lakes, these boilers have been uniformly successful, and although difficult of repairs, may very naturally be inferred from the novelty of the form, and the whole might be, for various theoretical considerations, pronounced necessarily short-lived and troublesome, the experience of the few years it has been in use, seems to indicate a rather unlooked-for durability, and the style has won itself a degree of local popularity which might, perhaps, be more widely extended.



The boiler of the propeller *Troy*, from which the sketch is prepared, has been now more than three years in service without any expenditure for repairs.

The *Boston*, a small propeller of some 16 inch cylinder, running between Cleveland and Ogdensburgh, was the first on which this boiler was adopted, and the repairs have, to this day, cost about $250·00. The whole credit of the experiment is due to Mr. L. Parmalee, a boiler-

maker, of Cleveland, by whom most or all of this description yet in use have been constructed. The heating surface is somewhat more efficient than the same extent in any of the usual forms, the actual evaporation being taken as the index. The boiler of the *Troy* presents about 700 square feet of fire surface, and $31\frac{1}{2}$ of grate area. This supplies plenty of very dry steam at a pressure of 80 lbs. above atmosphere, to a cylinder 3 feet 6 inches stroke, and 28 inches diameter, making 55 revolutions per minute, and cutting off at $\frac{5}{8}$-ths of the stroke from commencement, the throttle being always wide open.

The boiler of the *Troy* having been constructed when the material was quoted at a much lower figure, the cost would be no data for comparison. A boiler now building in this form, and of almost precisely similar dimensions, is to cost $2250. The form and proportions allow a very considerable fluctuation in the water level, without exposing any surfaces to the direct action of the fire, and the large unobstructed water surface allows, what is rarely obtained in upright boilers, tolerably perfect separation of the vapor from the water, the per centage of water mechanically suspended, being, for obvious reasons, much less than in any of the ordinary forms. The steam is withdrawn from a point near the apex of the upper shell, the pipe bending down and coming out through the side, as indicated by the dotted lines.

Clothing with felting, or other non-conductors, is a refinement not yet introduced to any considerable extent, either on these or other steam boilers in those localities. Under all the circumstances, with natural draft and ordinary firing with hard wood, the results in several propellers most readily accessible, are as follows, the steam in every case being represented as "plenty" at a pressure of from 68 to 80 lbs.; throttle valve never used:

The *Niagara*, with a fire surface of 575 square feet, a grate surface of 28·3, and a cylinder 3 feet 6 by 22 inches, makes 56 revolutions, cutting off at $\frac{5}{8}$ths.

The *Forest Queen*, fire surface 537, cylinder 3 feet 6 by $28\frac{1}{8}$, makes 56 revolutions, cutting off at $\frac{1}{2}$.

The *Westmoreland*, (a fine propeller, 200 feet in length,) fire surface 710, grate 44, cylinder 3 feet 6 by 28 inches, makes 58 revolutions, cutting off at $\frac{5}{8}$.

The *Prairie State*, *Michigan*, and *Ogdensburgh*, each presenting 700 feet of heating surface, and $38\frac{1}{2}$ feet grate area, with cylinders 3 feet 6 inches stroke, and 22 inches diameter, make from 54 to 60 revolutions, loaded, cutting off respectively at $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{1}{2}$ stroke.

The consumption of fuel in the furnaces of these boilers, which are termed "conical vertical," in the Official Reports of the Inspectors, are recorded as follows:—

Niagara,	wood,	consumption,	$\frac{3}{4}$	cord	per hour.
Forest Queen,	"	"	$\frac{7}{8}$	"	"
Westmoreland,	"	"	1	"	"
Boston,	"	"	$\frac{3}{4}$	"	"
Prairie State,	"	"	1	"	"
Michigan,	"	"	$\frac{3}{4}$	"	"
Ogdensburgh,	"	"	$\frac{3}{4}$	"	"

There are now floating on the waters of Lake Erie, eleven or more of these boilers. The water spaces adopted, are uniformly 4 inches thick around the furnaces. The water jackets are somewhat thinner at the base, diminishing to only about two inches thickness at the top. The iron is

$\frac{5}{8}$-ths of an inch thick for the principal boilers, and $\frac{1}{4}$-th inch for the jacket, stayed every $5\frac{1}{2}$ inches. Water bottoms can probably be fitted without difficulty, but are not yet much employed, the bottom being usually a simple water pan supported on plain bars about two inches square.

This bottom affords a trifle less direct protection to the keelsons, but gives free access to water in case of accident, and allows a fire to make itself apparent in less time than does a brick bed. The size of the boiler now in use, ranges, in external dimensions, from 4 feet 6 inches, to 7 feet 4 inches, and in perpendicular height, from 10 to 17 feet. Its use is unobstructed by patent, or any "intention" to monopolize whatever advantages it may be found to possess.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, April 20, 1854.

Samuel V. Merrick, President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Two letters from the Royal Institution of Great Britain, London, were read.

Donations to the Library were received from The Royal Institution of Great Britain; The Royal Institute of British Architects; The Royal Geological Society, London; George Wallis, Esq., Birmingham, England; Hon. G. W. Manypenny, Commissioner of Indian Affairs; Hon. James Cooper, Hon. Joseph R. Chandler, U. S. Congress; Messrs. Gould & Lincoln, Boston, Mass; J. S. Dodge, Esq., Oriskany, N. Y.; The Managers of the State Lunatic Asylum of the State of New York; Chas. Corghi, City New York; M. W. Baldwin, Esq., Pennsylvania Legislature; J. Horrock, Esq., Frankford, Penna.; and Edward Miller, Esq., Dr. L. Turnbull, The Pennsylvania Institution for the Instruction of the Blind, Wm. H. Hazzard, Esq., and Messrs. Lindsay & Blakiston, Philadelphia.

Donation to the Cabinet of Minerals and Geological Specimens, from George Schall, Esq., Mount Carmel, Penna.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for March, was read.

The Board of Managers and Standing Committees reported their minutes.

The Committee on Instruction, reported that, \$ 440·25 were received from 79 pupils in the Drawing School of the Institute, during the Session, 1853–4, just closed.

The Actuary reported the organization of the following Standing Committees by the election of their chairmen, and appointing the time for holding their stated meetings, viz:

Committees.	*Chairmen.*	*Meetings.*
On Meteorology,	J. A. Kirkpatrick,	First Monday.
" Minerals, &c.,	J. C. Trautwine,	Second Monday.
" Arts and Manufactures,	Prof. J. C. Booth,	Second Tuesday.

Resignations of membership (6,) in the Institute, were read, and accepted.

New Candidates for membership in the Institute (8) were proposed, and those candidates proposed at last meeting (2), were duly elected.

Dr. Rand exhibited a new form of repeating pistol, known as Leonard's patent. The barrels, five in number, are fixed, the cones are in the axes of the barrels, and the caps are exploded by a revolving hammer, which is concealed in the stock of the weapon. The hammer is drawn back and caused to turn one-fifth of a revolution by a trigger, and discharged by a second trigger in front of that used for cocking. These are so arranged, that the pistol may be cocked and fired with one hand, and if both are drawn back at once, it does not cock, so that an accidental discharge is impossible. The mechanism by which the hammer is caused to revolve is highly ingenious, but cannot be explained without a drawing.

Dr. Rand also exhibited Porter's repeating rifle, in which there is a single barrel and a number of chambers arranged around the circumference of a vertical disk. These chambers are loaded, brought in succession to the barrel, and discharged.

Dr. Hare exhibited his instruments, called "cycloidographs," with numerous interesting and complicated designs produced by them. Dr. Hare noticed the applications of these curves to the purposes of industrial design, as well as to the whirlwind theory of storms.

Mr. Wm. D. Parrish gave the following account of an explosion which occurred on the Mississippi River.

The Kate Kearny exploded at St. Louis in February last. I was on board before and after the explosion. She had 4 cylinder boilers lying abreast in front of the wheel houses, 40 inches diameter, each having two return flues 14 inches diameter, made in the usual form with cast iron heads; the iron of the case was about $\frac{1}{4}$ inch thick, and the heads $1\frac{1}{4}$ inch thick; they were all supplied with water by a doctor placed aft the boilers, which forced the water through a horizontal pipe communicating with the bottom of each. She had two high pressure inclined engines, one on each side the boat. Her larboard boiler burst with great violence just as she was backing out of her berth early in the morning, making a complete wreck of every thing front of the wheel houses and destroying a number of lives. The force of the explosion appeared to take a downward direction, throwing the front of the boiler upward, also flattening and bending the flues, and throwing fragments of them back on the engine with their front ends turned towards the stern. Portions of the boiler were thrown several hundred yards, damaging the fronts of large stores as high as the fourth story. Very little of the boiler was left on board. The rents were not confined to the lines of rivets, but took an irregular course through the sheets. From the best information I could obtain at the time, the explosion was caused by a deficiency of water; it was supposed the supply pipes were frozen, and the doctor did not act till near the time of the accident.

BIBLIOGRAPHICAL NOTICES.

Anatomy of the Invertebrata. By C. Th. Von Siebold.

Under this title, Messrs. Gould & Lincoln, of Boston, have recently published a translation from the German, by Waldo I. Burnett, M. D. This work is the first volume of the conjoint work by Siebold & Stannius, which is the standard work on Comparative Anatomy, and of which a French translation has been published by Lacordaire. By its conciseness, accuracy, and completeness, it recommends itself to every student of the department of science of which it treats. Copious notes and extensive bibliography serve to introduce the most recent observations, and the value of the work is farther enhanced by many additional notes by the translator.

A Treatise on Lightning Conductors; compiled from a work on Thunder Storms. By W. S. Harris, *and other standard authors.* By Lucius Lyons, A. M. New York: G. P. Putnam; 1853.

This little treatise is well calculated to supply a want which has long existed in our popular expositions of science; a want, which, it is not a little curious, should have so long existed among us. For the science of electricity, from the beauty of its experiments, and the exciting nature of its conclusions, has always been, and probably always will be, a favorite with those who seek amusement from physical researches, while the practical importance which belongs to the great discovery of Dr. Franklin, is calculated to fix the attention of a people who, like our own, are continually seeking to draw from Nature, secrets which can be made available for the uses of society. It is very strange, therefore, that in a country like this, where education is so widely diffused, where so many are endowed with unusual acuteness, and where early training leads to habits of close observation and independence of authority; in a country, too, where the phenomena of thunder storms are so common, and the damage resulting from them so frequent and serious, no attempt has ever been made to go beyond the explanations given by the great originator of the system of protection; and to apply the many and important discoveries which have been made in reference to electricity since Franklin's day, to the perfection of his lightning rod.

In France, the subject has attracted the attention of Arago, Gay-Lussac, and a number of others. In England, Mr. Harris has applied the discoveries of Faraday to the development of its theory, and the consequent practical perfection of the instrument. The treatise which we are now called upon to notice, is a digest of Mr. Harris's large work upon this subject, and presents within a small compass a well-condensed epitome of his views. As the author is an Electrician of great merit, and has given much attention to the subject, the work is a very valuable one, and although we may differ from some of his opinions, yet as a whole, we can heartily commend it to our readers, who are all, more or less, interested in it.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

JUNE, 1854.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Rough Notes of an Exploration for an Inter-oceanic Canal Route by way of the Rivers Atrato and San Juan, in New Granada, South America. By John C. Trautwine, Civ. Eng., Philad.

(Continued from p. 299.)

Quibdó is situated on the east bank of the Atrato, at the confluence of that river with the Quíto and Cabí. (See Plate XII.) It stands on one of three or four contiguous isolated hillocks of gold-gravel and clay. The highest points of the site, parallel with, and close to the river, are some six or seven feet above the highest freshets, but decline inland, so that at a few hundred yards back from the town, the water of high floods completely surrounds it. Owing to the incessant rains, even the high parts are reduced to a marshy condition, and a deviation of a few rods from the paved portions generally entails the penalty of muddy feet, or even of muddy knees, to one who does not happen to know where the hard spots are.

The space occupied by the town could readily be drained by a judicious system of ditching, and with but little labor or expense. By this means an area of about a quarter or one-third of a square mile might be rendered applicable to building purposes. As it is, we could stroll in no direction for more than five minutes without being turned back by swamps. High wooden clogs are in general use among such of the inhabitants as indulge in the luxury of boots or shoes, although I consider it very doubt-

ful whether any of that class has ever walked about the town for ten continuous minutes unless on occasions of religious processions. Many of the better class, especially the females, live and die without having walked a mile at a time during their lives.

Where the sphere of pedestrianism is restricted within such narrow limits, it might be supposed that the precaution of carrying an umbrella as an ordinary appendage, might well be dispensed with. But such is not the case, for the frequency of showers, which come up with scarcely a moment's warning, renders an umbrella indispensable at all times on leaving the house for even half an hour.

The authorities of the town have for a long time been compelled to forbid the washing for gold in the gravel on which it stands. But for this precaution the river banks would have been undermined, and the whole town plot filled with holes. It is true, that the gravel here is not very rich in this metal, nor, indeed, is it searched for in any part of the main Atrato below Quibdó, although found in quantities in the upper portions of *all* the eastern tributaries. On this account, I at first supposed that Quibdó was so far removed from the sources of the gold in the western Cordilleras, that the force of the current of the Cabí, and Quíto had not been sufficient to transport the particles to that point. But, as I afterwards saw very rich deposits at greater distances from the place of origin, I was obliged to abandon this idea, and to substitute for it that of a casual inequality of distribution.

There are no wharves or other provisions for the convenience of discharging boats, further than a few stout stakes firmly driven, to which they may be secured. The river banks descend to the water's edge very abruptly, and one must crawl up, or slide down, the best way he can. Just after a shower, when the banks are particularly slippery, this is a feat requiring both care and agility. One of the landing places was just in front of our house, and I have frequently been obliged to use a pole in order to surmount it.

It is dangerous to employ the hands for ascending the bank on all fours, inasmuch as every blade of grass has its colony of yavís, which attach themselves to the flesh, and unless detected and removed, insert themselves into the skin, producing a very troublesome itching for several days. The mere picking up of a stick to walk with, or the searching for specimens of any kind among the grass, was sure to be attended with this annoyance. How the natives become hardened to it, I cannot conceive, but so they do. We found yavís at every point of our exploration, from ocean to ocean.

Sitting on our balcony, which almost overhung the river, I could cozily smoke my early morning segar, while exchanging salutations with the young ladies who resorted to this spot about sunrise to bathe. No imaginable impropriety was involved in these innocent chit-chats, as I am, myself, a model of modesty; and the ladies, with the most becoming sense of decorum, rarely exposed their persons much more than half way down, or if they did, were sure to tie a handkerchief in front, or throw one over their shoulders. Sometimes, it is true, an antiquated specimen of the "strong minded woman," scorning the restrictive conventionalities of society, would divest herself entirely, and flounder about *in puris natu-*

ralibus, probably with a segar in her mouth. If the "woman's rights" advocates succeed in their rebellion, we may reasonably hope soon to see our own ladies adopting these tropical customs, in connexion with which, I would humbly suggest the gratification they would derive from learning to dive with a lighted segar in the mouth. Paradoxical as this proposition may appear, the process is quite simple, and the art by no means difficult of attainment. Nothing is more common in many parts of New Granada, than to see persons of both sexes smoking with the lighted end of the segar in the mouth. This does not interfere with their volubility, and I have repeatedly seen swimmers dive to a considerable depth, without extinguishing their segars, or supposing they were performing anything extraordinary.

The water nymphs would sometimes indulge in a song, which, as they all affect a most distressing nasal twang, generally drove me into the house. It is difficult to imagine any thing (unless it be a choice passage in the Italian opera,) more excruciating than a quartette vigorously emitted through the nose, with the force which none can apply as do these unsophisticated syrens of the Atrato. Nor is this peculiarity (which evidently has its prototype in their church music,) confined to the females; the males, also, are afflicted with it. Our boat's crew were singing as they worked, from morning till night, and when occasionally a little boy, a fellow passenger, actuated by a laudable spirit of rivalry, added his feeble treble to their sonorous sniffles, a harmony was produced suggestive of a duett on the nose between a lion and a tomtit.

Our landing place was not only resorted to by bathers, but served as a kind of "Rialto where servants most do congregate." These would be seen, early in the morning, filling their earthen jars with drinking water for the day, and chatting merrily with others, who, within ten feet of them, would be emptying and washing utensils of a very different character. The sensitiveness with which we recoil from certain associations of the agreeable and the disagreeable, in matters of culinary or gastronomic character, forms no part of the Granadian creed, at least among the commonalty. I actually, on one occasion, detected my black cook paring his toe nails with the carving-knife; and have frequently seen the lower classes while eating with their fingers, suspend operations for a moment by particular request, to relieve the head of a neighbor from a few entomological specimens, without being at all choice as to the direction in which they were thrown when captured.

The houses in Quibdó are, with very few exceptions, one story in height, and constructed chiefly of split palms and canes, with a small proportion of hewn timber. The floors of the poorer kind are of earth, while those of superior class are formed of split strips of the outer part of the palm, boards, or brick. Two or three, which were formerly occupied by persons of wealth, while the country was subject to Spanish dominion, have floors of tessalated Italian marble, which forms an odd contrast with the perishable materials of the walls. The roofs are generally thatched with palm leaves, but some are covered with earthen tiles made at the town. These tiles are merely laid on the woodwork of the roof, at a pretty steep angle, without any fastening, inasmuch as winds sufficiently strong to displace them are almost unknown in Quibdó.

The constant heat of the climate precludes the necessity for glass in the windows, which are merely protected by cross-bars of wood or iron. The entire details of construction would be considered very rude with us; nevertheless, the buildings are comfortable and commodious, to one who can lay aside his predilections for finished workmanship, and become oblivious to the interstices in most of the partitions, which conflict shockingly with our ideas of privacy.

No precaution is adopted against fire, except the nightly patrol of a watchman, although the combustible materials of which the houses are built, would insure its destruction in a few minutes.

Nearly every house is a shop, in which the systems of selling and bartering extend to every imaginable object that can be procured to sell or barter. Occasionally, by chance, a few articles of comparative luxury find their way here from Carthagena. Among these, Mr. McCann, after diligent search, discovered some sardines, bottled ale, and claret, the whole of which we purchased for our remaining trip, and, as the result proved, it was very fortunate for us that we did so.

Some portions of the side-walks of the town are roughly paved with large rounded pebbles.

About 70 years ago, Quibdó consisted of but two or three Indian huts, and was known as Citará. It is still frequently called by this name, (and occasionally by that of Chocó,) in the neighborhood.

The population is about 1500. Of these, the greater portion, (perhaps two-thirds,) are blacks, and the remainder Indians, with a few whites, as is the case in most parts of the Republic.

Quibdó is the emporium of foreign merchandise for a great extent of very sparsely populated territory. It is all procured from Carthagena, and some idea of its limited amount may be formed, from the fact, that its transportation requires but about one boat of from 20 to 30 tons burden, monthly. The average value of the cargoes usually ranges between $2500 and $5000; so that $50,000 may be considered a liberal estimate for the amount of foreign merchandize annually consumed in Quibdó, and the adjacent region. The great bulk of the articles is of inferior quality, adapted to the necessities and primitive tastes of the poor and semi-civilized negroes and Indians, among whom it is distributed.

Of these, the former generally pay for their purchases in gold dust, and the latter in the produce of their little "rosas," or patches of cultivated ground. The Indians here are strongly averse to searching for gold, probably a consequence of their traditional sense of the horrid barbarities which its possession entailed upon their ancestors at the time of the Spanish Conquests. They conceal all knowledge of rich localities, and even take the trouble to obliterate evidences of their existence, when it is in their power to do so. The blacks, not being burdened with such disagreeable reminiscences, have no scruples in hunting for gold; indeed, it constitutes the principal active occupation of the greater proportion of them; many are refugees from justice from every part of the Republic, who find a secure retreat from pursuit in the fastnesses of the forest-covered mountains, in the defiles of which their searches are conducted.

It is needless to remark that their operations are carried on without

the aid of science or system. Each one hunts for himself, and a calabash or wooden bowl comprises the inventory of his machinery. Aiming at nothing more than barely to supply the absolute necessaries of his vagabond existence, (which exact but few more appliances than those possessed by the beasts of the forest,) it may well be imagined that his exertions are light, and their result correspondingly insignificant. Still, Dr. Key informed me that in consequence of the numbers employed in this avocation, the gold dust annually brought into Quibdó, amounted in value to about $ 200,000. It is carried to the stores in very small quantities, frequently tied up in a leaf by the tendril of a vine. Thus gradually accumulated, it constitutes almost the sole medium of payment for the merchandize purchased in Carthagena.

The store-keepers are careful to apprize the gold hunters of its real value, as estimated in coin. By this means strangers are prevented from making great bargains in the precious commodity, as they would have to pay for it, very nearly its actual value; whereas, the store-keepers themselves, obtain it in barter for their goods, upon which they fix prices "ad libitum."

Beside the articles of foreign importation which are carried from Carthagena to Quibdó, such as textile fabrics, groceries, crockery, &c., there are some provisions of home production, such as yams, rice, cheese, jerked beef, &c. Paucity of population, combined with indisposition to labor, prevent these from being raised in the immediate vicinity in quantities sufficient to supply the demand arising from 1500 stomachs. There is no cultivation whatever, immediately contiguous to the town, but the supplies of such articles of food as the natives raise, are brought from the little rosas prepared along the levees of the Atrato and its branches, for many leagues around; and even from the valleys of the Cauca, Baudó and San Juan.

From the immense extent of country in which gold here exists in large quantities, in combination with the inducements offered to immigrants by the government of New Granada, I cannot doubt that when the lapse of a few years shall have served more fully to extend the knowledge of these facts, an excitement and influx of foreigners to the slopes of the Western Cordilleras, will take place, exceeding even those attendant on the discoveries in California and Australia.

Here, not only gold, but platina abounds; and in sections of the Republic more to the eastward, mines of silver and copper have for a long time been profitably worked. Most of the platina is, at present, derived from the vicinities of San Pablo, Nóvita, and Lloró. Near Bogotá, (the seat of government of the Republic,) are the celebrated emerald mines of Mussa, and no doubt can exist that when the country shall have been subjected to a proper geological examination, mineral treasures will be found as richly disseminated as in any known part of the earth.

There is no reason, whatever, to doubt that an almost uninterrupted deposit of the precious metals extends through the entire western portion of both Americas, from the extreme north to the extreme south.

Perhaps the chief, if not the only, extensive interruption of this great deposit, will be found to be where the igneous rocks of the Cordilleras are replaced by the slighty elevated transition formations that occupy the

region comprised between the Carribbean Sea on the northeast, and the Pacific Ocean on the southwest, and through which flow the rivers Guácuba, Atrato, and San Juan.

Through this region, there appear to me to be indisputable proofs that the waters of the Pacific and Atlantic were united at no very distant geological period. The only rock I saw in place between the Gulf of Urabá, and the Pacific at Buenaventura, was a gray tertiary sandstone, of various degrees of induration, from that of merely semi-indurated arenaceous clay, up to hard, perfectly formed stone. In every instance it contained fossil shells. I met with it at both the points at which I crossed the partition ridge between the Atrato and the Pacific, as in all the low parallel lines of hills which I have represented on the Map, (Plate XII,) as bordering the Pató, the Baudó, the Surúcco, and the San Juan. The same rock is found at the same ridge in crossing from the Napipi to Cupíca.

Gold has, I believe, been nowhere found to the west of this transition ridge of partition; but to the east of it, from below the latitude of San Pablo, it everywhere occurs in the diluvial gravel up to the very foot of the ridge. Near the head of the Surúcco I saw negroes washing rich gold-gravel at an elevation of some 30 feet above the level of the stream. These I conceive to be incontestible proofs that the gold-bearing diluvium has been spread over this region at a period subsequent to that of the elevation of this ridge. If so, it is inferable thatt he Western Cordilleras, themselves, have undergone, at least, a partial upheave since the elevation of the partition ridge, as otherwise it would be difficult to suggest a tenable theory for the dispersion of the diluvium.

Dr. Halsted, who had visited some of the gold regions of California, pronounced this spot on the Surúcco to be as rich as any he had ever seen, although it was near the extreme western limit of the auriferous diluvium, and consequently, the farthest removed from the original place of deposit.

Violent winds are of so rare occurrence about Quibdó, as to be almost unknown. Those from the north and north-east, which prevail during the months from December to March, near the Gulf of Urabá, lose themselves in ascending the Atrato, until they nearly die away about the mouth of the Murrí. To this point boats have ascended during the season of the northers, by the aid of sails only.

Situated so near the equator as latitude $5\frac{3}{4}$ degrees north, and at an elevation of less than 100 feet above the level of the sea,* it may readily be imagined that when the sun shines brightly, the heat at Quibdó is

* A comparison between two sets of careful in-door observations of my barometer, at Carthagena and Quibdó, give the elevation of the latter above the level of the sea, at about 70 feet; whereas, a mean of those taken at Túrbo, gives about 100 feet. If we assume the average fall of the Atrato for 220 miles from Quibdó to the Gulf of Urabá, to be three inches per mile, (which cannot, possibly, be far from the truth,) we should have a total descent of the river itself of 55 feet, to which may be added about 15 feet for the ordinary elevation of the town above the river, making 70 feet. Upon this data, I assume above, that Quibdó is not more than 100 feet above the level of the sea. I regard the elevation deduced from my occasional levels of the descent of the Atrato, as more dependable than those derived from the barometer; inasmuch as the indications of this instrument are subject to many irregularities which prevent it from furnishing correct results. The mean of the three calculations gives 80 feet.

great. Fortunately, however, the almost constant prevalence of mists and clouds serves to mitigate its intensity to such a degree that I found the usual temperature in the open air to be less oppressive than at Carthagena, and at other points at the same level in much higher latitudes, but possessing a clearer atmosphere.

I suspect that there are few places on the face of the earth where rains are more frequent than in the region about Quibdó. It probably does not happen twenty times in a year, that twenty-four successive hours pass without more or less rain.

During our stay of two months, it took place but twice, although once we had the *very unusual* occurrence of three consecutive days in which the only rain that fell was in light showers at night. The river empties itself rapidly during intermissions of rain about its sources, and this last occasion was attended by the lowest stage of water we saw at Quibdó, namely, about five feet in the deepest part of the channel in front of the town.

Late in the afternoon of the last of these three dry days, there came on a tremendously heavy rain, attended by he most vivid, blinding, and literally incessant lightning, and the most prolonged and fearfully heavy peals of thunder, that I ever saw or heard. For one hour, I do not think there was, at any moment, an intermission of startling flashes for one second ; and during that time the roar of the thunder resembled the continuous discharge of heavy batteries in the street, and on the roof of the house. At times the sound appeared to be between us and the roof, and we expected every moment to have the building down on us. The wind was quite moderate during the storm (which lasted only two hours) shifting first from east to west, and then to the north. The barometer exhibited no unusual disturbance either preceding or during the storm.

Just one month after our arrival, Dr. Key sent in a hurry to inform me that the atmosphere was sufficiently clear to allow the Cordilleras to be seen from near his house. On going to the spot, I found them to be very plainly discernible, but a re-gathering of the mist shut them out from view in a few minutes. This was the only occasion in which they were visible from Quibdó during our two months' stay.

It was not until the night of the thirty-sixth day after our arrival, that the sky was sufficiently clear to allow us to observe the stars for determining the latitude of the town. This also, was the first night on which no rain fell.* I suspect that more than three-fourths of the rain falls

* It was in consequence of the cloudiness of the nights, that we determined so few latitudes. Only that of Quibdó, which we had two or three opportunities of verifying by both northern and southern circumpolar stars, can be depended upon for accuracy. We were sometimes much troubled by the deposition of dew on the glasses of our pocket sextants, while observing, and as, from the construction of the instruments, we could not wipe them at a moment's notice, it is most probable that our other latitudes may be in error a few minutes. None of them vary more than five minutes from those given in Acosta's Map, except that of Vigia Curbarador, which I place fifteen minutes more to the south than he has it. Being confident, that in the case of Quibdó, he is slightly in error, I have also retained my other positions, notwithstanding their chance of inaccuracy. The position of the Vigia, moreover, agrees quite well with my protraction of distances. The nights on which the observations were taken for Quibdó, were perfectly clear at the time.

during the night. The clouds generally begin to increase in density sometime during the afternoon, and if rain does not commence at that time it is pretty sure to do so early in the evening, and continue during a great part of the night.

The "dry season," emphatically so called, is a period of but from 5 to 10 or 12 days, which occur during the veranillo de San Juan or short summer of St. John, generally some time in June. During this short interval, there is considerably less rain than usual, and the river gets down to its lowest stage. With this exception, and a somewhat similar one, which generally takes place in February, the Atrato rises and falls within nearly the same limits in almost every month.

The lower classes do not burden themselves with much dress; and it is quite common to see laborers and boatmen walking the streets with no other vestment than a piece of rag tied around the middle. The Indians sometimes resort to the less expensive substitute of painting their bodies. The first specimen of this operation that fell under our notice, was at the mouth of the River Opagadó, where we stopped for one night. An Indian dance was to take place that evening within a few miles, and an Indian woman nearly naked, was painting a pair of black breeches on her husband, who was otherwise entirely destitute of clothing. Squatted on the river bank in front of their hut, with a calabash of black dye between them, she was liberally smearing the contents over him with her hands. They resembled a brace of solemn baboons at mischief over a tar pot. He had a cable of strings of beads around his neck, while his wrists were graced with silver bracelets about six inches deep, resembling two beer mugs with the bottoms knocked out. When the breeches were finished, she added a pair of suspenders, and then, by way of finale, applied two or three spats of color to his snout, when, lo! before us stood the beau ideal of the Indian dandy of the Atrato,—the "finished gentleman from top to toe." She regarded him for a moment with admiration,—"He was all her fancy painted him." He, gazing for a moment at the neat fit of his pants, emitted a grunt of satisfaction, then seized his paddle, and with two bounds down the steep river bank, sprang into his little canoe, and shot away to the dance.

Black and red appear to be almost the only colors used, and their employment, so far as I observed, was confined to the Indians; the negroes not appearing to have much taste for this branch of the fine arts.

On the San Juan, we afterwards met with some tattooed Indians.

The passion for gambling pervades, more or less, all classes. Those of the lower grades seem to be actually impatient to get rid of their money as fast as they earn it; and surplus funds are sure to vanish at cards, or a cock-fight, at the earliest opportunity that offers.

All classes, when properly approached, evince an almost innate courtesy, and desire to please. During a residence of several years in New Granada, I have been repeatedly brought into contact with persons of every grade, from the highest to the lowest; and from all alike I have invariably experienced the freest hospitality, and unfailing courtesy. This latter trait of character actually appears to be inborn, and not the result of education. Ask any little naked Señor Caballero Jesus, or

equally naked little Señorita "Concepcion de la Virgen,"* whom you may chance to encounter in the street, to allow you to light your segar by the one he or she may be smoking; it is instantly presented in a graceful manner, with a "con mucho gusto Señor," (with much pleasure, sir.) The youngest child will never be seen to laugh at your deplorable efforts at speaking Spanish, but will listen and reply to you with a decorous gravity that might shame a Senator.

I never, in all my Granadian experience, felt myself to be among ruffians; and the only precaution necessary to ensure the kindness and good will of all, is, merely to conduct yourself in a manner deserving of them. It is to be regretted that this simple means of attaining so desirable an object should be so seldom resorted to by either the English or Americans who travel among them, and who appear to rely more upon a snobbish and vulgar assumption of superiority, which, while it is almost invariably endured with forbearance and politeness, fails in effecting more than a conviction, on the part of their auditors, that their guests are, at least, extremely ill bred. A thousand times have I had reason to be ashamed at the contrast between my own countrymen and even the lowest classes of New Granadians, in point of conventional courtesies. John Bull and Brother Jonathan, with all their boasting, are, so far as my opportunities of observation extend, the most unfit (money and courage excepted,) of all the nations of the earth, to travel with enjoyment to themselves and to those with whom they are brought in contact. The French, Germans, Spanish, indeed, the representatives of all the nations with whom I have met in my wanderings, enjoy an aptitude of assimilation, a certain faculty of being happy, and making others happy, an ease of conformity to the customs of the place in which they happen to find themselves, for which we look in vain, in the owl-like, stolid, self-sufficient, bull-doggedness of the Anglo-Saxon race. Among the Indian tribes through which I passed, I laid aside my pistols, and armed myself with a pocket full of segars; a present of an empty sardine box was more effective than a two-edged sword; and a lump of our sugar to a papoose was a better passport than my government could have furnished.

As to musquitoes, we saw but few on the Atrato, except for the first few nights above the Gulf. Even these we should have avoided had our patron been willing to anchor his boat a little further out in the stream. Some portions of Quibdó, in which little attention is bestowed upon cleanliness, are troubled with them; but I do not remember to have seen one in the house we occupied. There are a good many fleas, however, or a species of diminutive sand fly, that at times annoy very much.

The Republic of New Granada is divided into thirty-seven provinces, which sustain, towards the general government, a relative position, similar to that of our own States. These, again, are subdivided into cantons and parochial districts, corresponding to our own counties and townships.

The province of Chocó, of which Quibdó is the capital, comprises the greater portion of the territory shown in the map, Plate XII. I have, unfortunately, mislaid the memorandum of its precise limits, as furnished by Governor Contó. According to the census of the Republic for 1851,

* "Gentleman Jesus;" "Conception of the Virgin;" not uncommon names.

a copy of which was kindly prepared for me by his order, the population of the province of Chocó is as follows:—

Canton of Atrato.			
District of Quibdó,	.	8471	
" " Arrayanál,	.	1125	
" " Bebará,	.	4034	
" " Lloró,	.	4035	
" " Murri,	.	2009	
" " Murindo,	.	2007	
" " Túrbo,	.	916	
			22597
Canton of San Juan.			
District of Novita,	.	6097	
" " Baudo,	.	3036	
" " Noanamá,	.	3510	
" " Sipi,	.	2021	
" " Tado,	.	6388	
			21052
Total of Province of Chocó,			43649

According to the same census, the population of the entire Republic amounted, in 1851, to 2,243,730.

After a stay of four or five days in Quibdó, I determined to prosecute my explorations by ascending the Pató, a branch of the river Quíto, which heads in the dividing ridge between the waters of the Atlantic and Pacific. At Quibdó, the Atrato divides into two principal branches of about equal size. That to the east still retains the name of Atrato, while the western one is called the Quíto. The tributaries of the Quíto branch flows almost entirely through diluvium, and consequently its waters are yellow and muddy; while those of the Atrato branch, having their sources in the Western Cordilleras, and flowing principally through channels of rock and pebbles, are quite transparent. For some distance below the junction of the two at Quibdó, the line of separation between their respective waters, is well defined. The Atrato, not being at all available for the object of which I was in pursuit, it only remained to ascertain what facilities were offered by either the Quíto, or its tributaries, for effecting a union with the waters of the Pacific. It had been suggested to me at Quibdó that I should find the route by the Pató in conjunction with the Baudó, which empties into the Pacific some 50 miles above the San Juan, to be preferable to that by way of the Quíto and San Juan itself.

On reference to Acosta's map, I found the Baudó laid down as quite an insignificant stream, which fact augured badly for the successful result of that portion of my examinations. But as my authorities in Quibdó were unanimous in their assurances that I should find the Baudó to be a far more important river than the map represented it, I resolved to hazard a few days in paying it a visit.

The opinion as to the height which I should find the partition ridge to attain were somewhat diverse, varying between 18 feet, and 4000 feet. The first limit was stoutly maintained by Father Ochóa, the high priest (stature about 5 feet 3 inches) of Quibdó and the adjacent precincts, "to whom we were indebted for several agreeable visits, pro and con, during our stay." "He had been a soldier in his youth, and fought in

famous battles," which supplied him with a great fund of anecdote. The old gentleman had unfortunately acquired among his flock a reputation for shooting an "almighty long bow," but notwithstanding the several intimations to that effect that had been conveyed to me, I felt rather inclined to pin my faith to his skirts, inasmuch as in our numerous conversations he appeared to evince habits of close observation, and I thought (my wish being father to the thought) that his asseverations might not only prove to be correct, but conduce to my achieving a small slice of immortality by the discovery of a feasible inter-oceanic communication.

I was, however, somewhat staggered by the assurance, (accompanied by a diabolically ominous shrug of the shoulders,) of one person who had crossed it two or three times, who, although he could not pretend to speak with any certainty as to the precise height, yet assured me that it would prove to be "algo" (somewhat). The sequel will show that I found his estimate to be the correct one.

I had supposed, like a simpleton, that in order to start on my pilgrimage, nothing more would be necessary than to go down to the landing, engage a canoe, and two or three paddlers,—tell them to put my traps and a few plantains on board, and be off at ten minutes notice. Consequently, early one morning, following the example of my thermometer, I rose with the sun, went to the landing, and accosting the owner of a canoe, bade him gird up his loins, and bring his boat around to our landing place, in order to load up with more facility.

He very courteously asked me for a light, and after having gravely set his segar in operation, told me he could not comply. The voyage was a long one, and required a good deal of deliberation and consultation among his kinsfolk,—provisions were very high just then,—himself and his family were victims to all sorts of distressing maladies,—his canoe leaked and would require repairs,—it was going to rain, (a truism at all times in Quibdó,) and besides, to-morrow or next day, would be time enough.

The inexperienced traveler on the Spanish Main is very apt to be continually annoyed by the dilatory habits and procrastinations of all with whom he has business to transact. This should not (as is usually the case) be imputed to them as a fault, but rather as a natural consequence, resulting from the heat of the climate, and the absence of those incentives to activity engendered by a more extended commerce or a general devotion to agricultural pursuits. The traveler from colder regions should therefore make ample allowances for these considerations, and temper his impatience down to the standard of inactivity which prevails in all tropical climates. Otherwise, he will be kept in an incessant fidget and ill humor; for no matter how pressing may be the occasion, how solemn the promises, how urgent his importunities, he is constantly met with the eternal "poco a poco," "mañana;" ("by and bye," "to-morrow.") "Take it coolly," "dont hurry yourself," "dont do to-day what can be done to-morrow," "time comes as fast as it goes," constitute the grand fundamental axioms of business operations; from the most important, down to the most trifling incidents of every day's occurrence. Do you complain? You are consoled by the assurance that it is the "costumbre del pais," (the custom of the country.) And so it is; therefore, the sooner

you learn to conform to it, the sooner will you be relieved from a most prolific source of irritation.

After applying to two or three other canoe men, with a result as unfavorable as the first, I stated my case to Dr. Key and Governor Contó, both of whom volunteered their services in my behalf. The consequence was, that by the end of five days more, I had secured a good trustworthy Indian patron, three bogas, and a rancháda. The only shelter afforded by the latter from the inclemency of the weather, was a little "toldo" or covering made of bent pieces of vine covered with long "musa" leaves. This toldo was 9 feet long, 3 feet wide, and 3 feet high in the centre. The rancháda was 43 feet long, by 12 inches deep; and drew, with our load, 6 inches.

Expecting to be absent only four or five days, we laid in but a small stock of provisions, a single change of clothing, our hammocks, and a gun. These, however, occupied so much space in the toldo, that it was impossible to stow into it more than two persons in addition, and even they required to be coiled up tightly. It was therefore decided that Dr. Halsted and myself only should go, while Mr. McCann remained behind to continue the observations on the stages of the river.

It was nearly 11 o'clock in the morning when we started to ascend the Quíto, and we reached a negro rancho near the mouth of the Pató, a distance of 17 miles above Quibdó, at 6 P. M.

As there was no other stopping place for a long distance ahead, we landed here, and requesting permission to pass the night in the house, received the invariable affirmative answer. The Doctor and I soon sat about getting supper, and had we practised all the incantation of Pharaoh's magicians we could scarcely have excited more wonder on the part of our worthy host (a venerable negro) and his family.

They had heard me address Halsted, as "Doctor," which is a word pregnant with mystery and great meaning among them, and prepared them for extraordinary things.

Squatting around us on the floor of the hut, like so many stripped mummies, they watched with intense interest the mysterious process by which Dr. Halsted was preparing our coffee, while I opened a box of sardines and a bottle of claret.

"Holy Virgin!" at last exclaimed the old man, striking his breast in an agony of astonishment, "can these blancos (whites) be men, or are they devils; they come into a poor man's house where there is no coffee, but they have coffee in their pockets; they pour some water (alcohol) under a machine (portable coffee maker) and some into the machine; they set fire to the water under the machine, with fire which they carry in a piece of paper in their pockets, (lucifer matches;) the coffee is ready, and then they put out the fire with a silk handkerchief;" (the Doctor extinguished the flame by laying his handkerchief on it.) "They must be devils," "they carry with them little fish in a silver box, they have wine, they have bread, they have everything; they must be devils." As we made him share with us, however, some portion of our delicacies, winding up with segars, and a calabash of brandy and water, he must have concluded at least that we were a set of good natured devils. Poor old fellow, I am afraid the Doctor kept him awake all night by showing him before

he turned in, our compass pointing to the north, while the compass-box was turned completely around; and afterwards making the needle chase a knife-blade: for as soon as this miracle was performed, he silently rose, and without saying a word, went out, and squatted down on the river bank with his head between his hands, evidently lost in deep meditation.

Next morning he refused any compensation for his kindness, except the claret bottle, and sardine box; and I suspect felt relieved when our boat paddled away.

(To be continued.)

AMERICAN PATENTS.

List of American Patents which issued from April 4th to April 25th, 1854, (*inclusive*,) *with Exemplifications by* Charles M. Keller, *late Chief Examiner of Patents in the U. S. Patent Office.*

APRIL 4.

1. For *Improvements in Drop and Die Forging and Punching Machines;* Solomon Andrews, Perth Amboy, New Jersey; patented in England, Oct. 7, 1852.

Claim.—"What I claim is, 1st, Lifting the drop or staff, near its central line of gravity, by means of a pinion running on a shaft operated by a clutch, combined with the driving power, whereby the stamp may be released and dropped at any point of its ascent, at the option of the attendant, and without stopping the other moving parts, as described. 2d, Hollowing out the stamp, and also the punch, for the formation of a reservoir to hold water or other proper fluid for keeping the punch cool, not limiting myself to a punch merely, but also as applied to any other tool fitted to, or used in combination with, a stamp for operating upon hot metals. 3d, Interposing between the stamps and the die, a secondary stamp or follower, so constructed as to effect the cutting off of the blank from the bar, and when combined with the bolster shall form the box or die in which the nut is forged, and which secondary stamp shall also act as a releaser to remove the finished nut from the punch, as described. 4th, The combination of the cam lever and the arc with the stem of the lower or discharging die, to be operated by the stamp during its ascent, in order to raise and support the lower die until the nut is thrown off, as described. 5th, The wedge-lever, in connexion with its spring and its lever or arm, operating as described, for effecting the complete disengagement of the clutch teeth, so as to prevent those from clashing when the stamp falls, the whole being constructed and operating as set forth."

2. For an *Improvement in Railroad Chairs;* Bernard J. La Mothe, City of N. York.

Claim.—"What I claim is, the construction of the frame of railroad cars with continuous elastic steel bands, or equivalent material, in the manner and for the purpose set forth, namely: the transverse bands, in pairs, each of one single piece, to extend from one side of the frame to the other, at equal or respective distances, bent to the proper shape of the car, and the longitudinal bands to pass, single, between the above, forming, with them, rectangular squares, and the three bands repeatedly in such position to be firmly secured together by means of rivets or screws in each intersection of the rectangles formed by them; thereby obtaining with said material, and from such an arrangement, combined with lightness, far greater strength and elasticity than the cars now in ordinary use possess, and consequently affording far more protection to life, in case of accidents, in railroad traveling. I do not claim the frame of single transverse and single longitudinal bands, but limit my claim to the use of single, double, triple, or multiplied longitudinal bands, combined with single, double, triple, or multiplied transverse bands, so that there shall not be less than three bands, while the number may be increased ad libitum, in each intersection of the angles formed by them, the whole being constructed and used in the manner and for the purposes above mentioned."

3. For an *Improvement in Treating Cane Fibre for Paper and other purposes;* B. A. Lavender and Henry Lowe, Baltimore, Maryland.

Claim.—"What we claim is, breaking down woody fibre of cane, and other like plants, and dissolving the gummy and other foreign matters therefrom, by means of muriatic or sulphuric acid, of the strength of 10° Baumé, or thereabout, preparatory to making hemp for bagging, rope, paper, pulp, &c., in the manner substantially as set forth."

4. For an *Improvement in Carriage Tops;* Rodney Miller, Middlefield, Ohio.

"The nature of my invention consists in so constructing a carriage top and seat, that a person upon the seat can, without rising from the seat, easily raise and lower the top by placing his foot or hand on the lever at the right of the seat, the lever being held in place at the desired point by catches upon the seat."

Claim.—"What I claim is, the combination and arrangement of the rods or straps, either separately or combined with the cranks and the arms, in the manner specified, and operated by the lever, for the purpose of raising and lowering carriage tops in the manner set forth."

5. For an *Improved Chain Cable Stopper;* Oldin Nichols, Lowell, Massachusetts.

Claim.—"What I claim is, preventing the backward slipping of the cable as it is drawn inward, by my improved method of providing a catch for every link by means of the roller, supplied with the projections, recesses, and ratchet teeth, in connexion with the pawls, all arranged and operating together upon the cable substantially as set forth."

6. For an *Improved Chain Cable Stopper;* Oldin Nichols, Lowell, Massachusetts.

Claim.—"What I claim is, the small guiding ridge in the bottom of and combined with the encircling groove, or its equivalent, in the sustaining roller, so as to cause the links of the chain to assume positions sufficiently inclined to be guided alternately on opposite sides of said ridge, for preventing the twisting of the cable, but at the same time to bring each link, against which the pawl acts, so near a vertical position as to be securely held by said pawl, substantially as described."

7. For an *Improvement in Gates for Water Wheels;* Elijah Roberts, Rochester, N. H.

"The nature of my invention consists in the arrangement of the devices by which the water has an advantageous direction given it in passing through the adjustable shute, combined with the sliding for operating the shutes, or the divisions constituting the shute; also in the mode of hanging these divisions on a fixed rod passing loosely through the shutes, by which means the clamping of them is avoided when the bolts holding the rims together are tightened, and, furthermore, in the device for simultaneously opening these shutes by an annular ring, gear, &c. It is to be understood there is no difficulty of the shutes closing, the water will do that when free from obstruction."

Claim.—"What I claim is, the arrangement of the rods, which are made to slide through the shutes or gates, so that all the gates or shutes may be opened simultaneously, or allowed to close by the pressure of the water when not obstructed by foreign obstacles, in the manner and for the purpose set forth."

8. For an *Improvement in the Preparation of Vegetable Fibres;* David A. Wells, Cambridge, Massachusetts.

Claim.—"I do not claim, broadly, subjecting vegetable substances to the action of acids, as this has been done before for other purposes, and under essentially different proportions and circumstances, and with a different view; and therefore I do not wish to be understood as claiming, broadly, subjecting vegetable substances to the action of acids, except when used for the purpose of removing bases which would entirely, or for too long a time, resist the chemical action of the other branches of the process employed to obtain cellulose. I am also aware that lignine has been separated from woody fibre by dissolving the cementing substances in alkalies, more or less caustic, as aids to subsequent mechanical operations for obtaining fibres; and I do not, therefore, claim simply subjecting vegetable substances to the action of caustic alkalies. I am also aware that vegetable substances, after being subjected to the action of caustic alkalies, have been treated with acids, but under different circumstances, and for a different object. Heretofore, this has been done for the purpose of removing any adhering alkali, and all other foreign matters, whilst, in my process, I use an acid of an entirely different strength, not for the purpose of removing any alkali remaining from the previous branch of the process, for this I previously wash out, and not for the purpose of removing any gummy or glutinous matter, for this

I previously remove by means of the caustic alkali. But I have found that the cellulose, treated with an acid of such a strength, and for such a length of time, is so altered that the subsequent bleaching, by the ordinary means, is greatly facilitated and cheapened; and therefore I do not claim, broadly, treating vegetable substances with acids, after they have been subjected to the action of caustic alkalies, irrespective of the circumstances and the purposes herein specified. 1st, Aware that acids have been used in the treatment of crude or unprepared vegetable fibres, chiefly for the purpose of breaking and mechanically separating the woody and gummy matters; I do not, therefore, claim any such process; but what I claim is, removing coloring and resinous matters, cleaned and dressed flax, hemp, and other equivalent textile and fibrous material designed to be spun, felted, &c., by means of weak acid of about 3° Baumé, in the manner as set forth. 2d, In combination with the above, I also claim the employment of caustic alkalies, as specified, to obtain cellulose from vegetable substances, for the manufacture of paper, and for other purposes, in combination with the use of alkaline earths, substantially as specified, to preserve or restore the caustic state of the alkalies, as set forth. And, finally, I claim, in combination with the process for the separation of cellulose from vegetable substances, subjecting the products thereof to the action of a solution of efflorescent salts, substantially as and for the purpose specified."

9. For an *Improvement in Cops for Sewing Machines;* W. H. Akins, Ithaca, N. York.

Claim.—"What I claim is, the use of a cop or bobbin, without spindle or spool, in combination with a shuttle, or what is equivalent thereunto, when the thread is drawn or fed out from the inside of the cop or bobbin, by which means I secure an uniform tightness or tension on the cop or bobbin thread, as it is drawn or fed out from the shuttle, as described."

10. For *Improvements in Water Wheels;* Lorenzo D. Goodwin, Peruevillc, N. Y.

Claim.—"What I claim is, 1st, The form and proportions of the buckets, as specifically set forth, commencing in a true circle at a tangent to the outer periphery, and terminating in a straight line fifteen degrees in length at the inner curve, and at a tangent thereto, as explained. Also, the self-regulating gate to the scroll, constructed and arranged in the manner set forth."

11. For an *Improvement in Candle Mould Apparatus;* Willis Hurniston, Troy, N. Y.

Claim.—"What I claim is, 1st, The wick stretcher, so arranged that the wicks may be uniformly stretched before the material is run into the moulds, and the friction or strain be removed therefrom before the candles are drawn from the moulds, to prevent the breaking of the wicks, substantially as described. Also, in combination with the wick stretcher, the centering bar or plate, with its stop or guide, for first properly centering the wick at the top of the mould before it is stretched and held, substantially as described."

12. For an *Improvement in Bedstead Fastenings;* Eastman R. Ball, Kalamazoo, Mich.

Claim.—"What I claim is, fastening the rails to the posts of a bedstead, by means of the combined sustaining brackets and conical fastening pins, secured to the posts, and the conical holes in the under sides of the rails, arranged and operating with each other, substantially as set forth."

13. For an *Improvement in Machines for Corrugating Sheet Metal;* Solomon G. Booth, City of New York.

Claim.—"What I claim is, the construction and arrangement of the dies, so as to adjust them to any depth of corrugation and thickness of metal, by having the pieces separate from the parts, so that they, as well as the cam shaft, can be raised and lowered to make a deeper or shallower corrugation, the whole being combined and arranged substantially as set forth."

14. For an *Improved Valve Cock;* Benjamin Eakins, Philadelphia, Pa.

Claim.—"What I claim is, the peculiar construction of the valve, with the manner of opening and closing the same, as described."

15. For an *Improvement in Amalgamating Gold and Silver;* A. K. Eaton, City of N. Y.

Claim.—"What I claim is, the employment of an alloy of mercury and zinc, instead of pure mercury, in the process of amalgamating precious metals, substantially as set forth."

16. For an *Improvement in Railroad Frog Guards;* H. W. Farley, East Boston, Mass.

Claim.—"What I claim is, the supporting of the track rail opposite the frog, on the projecting base of the frog-guard, as set forth, so that without the intervention of bolts or other fastenings liable to become loose or deranged, the guard is held down by the track rails; but I make no claim to supporting the frog-guard and adjacent track rails in a common chair, as this is neither new nor capable of affording the security against accidents which my invention affords."

17. For an *Improvement in Cranberry Winnowers;* Phanuel Flanders, Lowell, Mass.

Claim.—"What I claim is, the cleaner and the arms, or their equivalents, in substance, and the separator, when the same is made and operated substantially as set forth."

18. For an *Improvement in Machines for Making Friction Matches;* Wm. Gates, Jr., Frankfort, and H. J. Harwood, Utica, N. Y.

Claim.—"What we claim is, 1st, The employment or use of the endless chain, formed of a series of clamps, constructed and arranged substantially as shown, for the purpose of receiving the match sticks for the cutting tool, and conveying them to the sulphur and igniting compounds with which their lower ends are covered, as shown and described. 2d, The peculiar form of the cutting tool, as described, viz: said tool being formed of a series of circular cutters, connected by semi-circular cutters, by which form the match sticks are placed in the clamps of the chain, at a sufficient distance apart to prevent their lower ends from being cemented together when immersed in the sulphur, and covered with the igniting compound; said tool, also, by being constructed as described, cutting the match sticks smoothly and easily from the block. 3d, Opening or parting the clamps of the chain at the proper time, or when each clamp is directly over the cutting tool, by means of the wedge, operated by the cam, or its equivalent, for the purpose of allowing the match sticks to enter the clamps as the cutting tool ascends to the top of the block, as described."

19. For an *Improvement in Treating Vulcanizable Gums;* Charles Goodyear, New Haven, Connecticut.

Claim.—"What I claim is, the method of manufacturing compounds of caoutchouc, gutta percha, and other gums susceptible of vulcanization, in sheets, by covering the surface or surfaces of the sheets of gum with sheets of paper or cloth, or the equivalent thereof, and then confining the same during the process of vulcanization, by pressure between plates of metal, or their equivalents, or otherwise, substantially as described."

20. For an *Improved Machine for Cutting Veneers;* Carmi Hart, Bridgeport, Conn.

Claim.—"What I claim is, 1st, Cutting veneers, or other thin stuff, by giving to the shaving knife a rectilinear movement towards and through the log at the same time that a rectilinear movement is given to the log either transversely or diagonally to the movement of the knife, so as to produce a long continuous drawing cut, as described, whether the said movements of the knife and log are produced by the precise arrangement of mechanical means described, or any other substantially the same. 2d, Making the ways, upon which the log carriage moves, adjustable, as described, relatively to the ways in which the knife and cutting table move, for the purpose of giving more or less of a drawing action to the cut, as the nature of the stuff to be operated upon may require. 3d, Attaching all the necessary appendages for holding the log and feeding it to the knife to a turn-table, capable of being adjusted circularly within the main frame or part of the log carriage, as described, for the purpose of presenting the grain of the stuff at any desired angle to the edge of the knife or direction of the cut. 4th, Suspending the log or block above the knife, by griping it with clamps, which form part of a suspending head, which supports the weight of said log or block, and prevents it dragging over the edge of the knife during the backward movement of the latter, and only allows it to be lowered under the control of suitable feeding mechanism. 5th, Setting the lever handle, which holds the clamps upon the log, free from the notched bar, by which it is secured for that purpose by means of the bar and the inclined block, of which the former is attached to the suspending head, and the latter to some fixed point on the turn-table of the log carriage, and the former is made to slide, by coming at a proper time in contact with the latter, in such a way as to raise the lever-handle, as described. 6th, Making the slots in the clamps which receive the bar and screw, of such length that after the clamps are arrested by coming in contact with the proper part of the log carriage or turn-table, the motion of the follower and the other parts of the feed motion may continue till it is desirable to stop

them, as described. 7th, The mechanism described, for rendering the pawl of the feed motion inoperative, and thereby stopping the descent of the suspending head and the feed of the log at the proper time, to wit: the bar, pin, spring, rod, arm, shaft, feather. and angle piece, the whole being combined and applied substantially as herein set forth."

21. For a *Combined Table and Chair;* Stephen Hedges, City of New York.

Claim.—"What I claim is, the manner described, of rendering a table of ordinary construction susceptible of being combined with a chair, and of being used as a smaller stand or writing desk and chair combined, by constructing the table in two sections, and jointing said sections together, one of which forms a chair with a flap or removable top, and the other a stand, smaller table, or writing desk, with a stationary top, having the flap of the chair hinged to it, one end of each section being jointed together by a hinge, upon which the chair turns when it is desired to use the table as a stand or writing desk and chair combined, or after it has been used as such, substantially as described."

22. For an *Improvement in Treating Caoutchouc and other Vulcanizable Gums;* L. Otto P. Meyer, Newtown, Connecticut.

Claim.—"I do not claim interposing between sheets of gum, &c., to be cured, sheets of flexible material, when the series of sheets thus piled are confined between plates of iron during the process of vulcanization, as this makes no part of my invention, which consists in covering the surface of what is known as the hard compound of caoutchouc with tin foil, or other equivalent substance, to preserve the form previously given by embossing or moulding, the contact of the tin foil during the curing process having the effect, as I have discovered, to preserve the form and the surface, without pressure or moulds. What I claim is, the use of tin foil, or the equivalent thereof, for the purpose of preserving, during the process of heating, the forms or shapes given to the hard compounds of vulcanized caoutchouc, and other vulcanizable gums, substantially as described."

23. For an *Improvement in Enema Syringes;* Morris Mattson, Boston, Mass.

Claim.—"What I claim is, 1st, The combination of the thumb or finger rest with the barrel and piston, and for the purpose essentially as specified. 2d, The upper ring valve seat, and the perforated tube, in combination with the disk or valve, and its seat and chamber, the same being made to operate substantially as described."

24. For an *Improvement in Machines for Making Wire Netting;* Jno. Nesmith, Lowell, Massachusetts.

Claim.—"It being understood that the take-up motion acts or operates at the right time, so as to keep the wire straight and smooth during the operation of the said machine, as set forth, what I claim is, 1st, Revolving the wires, by the means substantially as described, for the purpose of keeping them parallel to each other, so that they cannot get entangled with each other during the process of making the netting or fencing. 2d, Vibrating the wires alternately from the left to the right, or the right to the left, before or after, or at the same time of twisting them the said wires together, by means of the cams and the shippers, and connected to the said cams by levers. 3d, The jaws or clamps, or the same in substance, for the purpose of drawing the wire through the machine at the required times by means of the cams and levers, operating the same essentially as laid down in the within specification and drawings. 4th, The two planes and their mechanical equivalents, with the cams and levers for operating the same, substantially and for the purposes set forth. 5th, The wire reels and movable reel stands, with the friction springs for the reels and holes through either end of the said reel stands, for admitting, protecting, and guiding the wire, or the mechanical equivalents of the said reels and reel stands. 6th, The feeding and twisting gears, with or without their centres perforated to admit the border or warp wires passing through the same, and the said gears having slots cut in them for the receiving and sliding of the ends of the stands and wires in the same, substantially as set forth."

25. For an *Improvement in Drills for Metal Drilling;* Abiel Pease, Enfield, Conn.

Claim.—"I am aware that drills have been used with a hole in the centre, extending lengthways of the drill, but such I do not claim; but what I claim is, constructing a drill for drilling metals, with a notch, with two cutting edges, which leave a guiding cone in the centre of the hole as it is bored, which is cut down as the drill advances, in combination with the beveled edges of the lips, substantially as set forth."

26. For an *Improvement in Training Posts;* Joseph Sollenberger, Higginsport, Ohio.

Claim.—"I do not claim a post, in itself, nor a wire hook, in itself; but what I do claim is, a training post, composed of a staff and hooks at proper intervals on the staff, for the purpose of rapidly treating and dressing vines, in the manner described, and at the proper season, the staff and hooks being prepared and located all ready for instant action when the season for vine dressing arrives, the whole being combined and used substantially in the manner and for the purpose described."

27. For *Improvements in Pumps;* Joseph Edson, Boston, Massachusetts.

Claim.—"What I claim is, the cap, with its valve, constructed and arranged in the manner substantially as described. The cap being cut away upon one side for the accommodation of the valve, and packed at the points, to prevent the return of the water from the passage to the cylinder, the valve being made to bear immediately upon the upper end of the cylinder, by which construction and arrangement of parts I am enabled to force out from the cylinder each time the valve is raised, any air which may have collected above the piston, and thus effectually avoid the air cushion above the piston."

28. For *Improvements in Heating Skelps for the Manufacture of Wrought Iron Tubes;* James McCarty, Reading, Pennsylvania.

Claim.—"What I claim is, the new method of operating, as described, viz: heating the skelps in a furnace constructed substantially as set forth, with raw coal as fuel, whose combustion is maintained by a blast of air forced into the furnace under pressure, as set forth."

29. For an *Improved Bit Fastening for Cast Iron Bench Planes;* Wm. S. Loughborough, Victor, N. York.

Claim.—"What I claim is, 1st, The combination of the adjustable lever cap with the screw by which it is operated. 2d, The manner of connecting the said adjustable lever cap with the stock of the plane, as described."

30. For an *Improved Machine for Crozing the Ends of Staves;* Geo. W. Livermore, Cambridgeport, Massachusetts; patented in England, Aug. 31, 1853.

Claim.—"What I claim is, the combination of the carrying drums, the pressure bars, and the revolving cutters, with the hopper, for the purpose of delivering the staves, one by one, to the cutters; the hopper being constructed as represented, to permit the escape of the stave on one side, and not on the other."

31. For an *Improvement in a Machine for Drying Tobacco;* T. Lafetra, City of N. Y.

Claim.—"What I claim is, the drying tobacco by forcing currents of air through it, in combination with the confining thereof, by means of the chambers or cells formed and constructed as described, or by any other mode that is substantially the same and will produce the same result."

32. For *Improvements in Making Railroad Chairs;* John C. Ogden, Assignor to Chas. S. Ogden Philadelphia, Pa.

Claim.—"I do not claim the chairs described and illustrated, nor any other particular form of chairs for railroad rails; nor do I claim operating the punches and dies by means of cam rollers; but what I do claim is, making chairs for railroad rails by passing the 'hot mill bars direct from bar rolls out of which the chairs are to be made,' without reheating, 'and by the same working hands usual at roll train between a pair of rolls, constructed and operating on the principle substantially as described, and the punches and dies for punching and forming the chairs being secured around the peripheries of said rolls, substantially as described."

APRIL 11.

33. For an *Improved Coffee Pot;* James McGregor, Jr., Troy, New York.

"The nature of my improvements consists in surrounding the bottom (or bottom and sides as far as may be desired) of tea or coffee pots with an outer case, which may or may not be attached to the tea or coffee pot, leaving a space for water between the inner and outer case, of sufficient capacity to prevent evaporation from reducing the water between the two cases below the bottom of the tea or coffee pot, while the tea or coffee is being prepared, &c. There is no loss from evaporation, none being allowed; the coffee or tea may be steeped some time longer to advantage than in the former mode. 2d, In having

a mouth-piece to the outer case for the purpose of pouring water, or other fluid, between the two cases; while the pot is on the heating apparatus, this mouth-piece is always to be kept open. When it is removed from the heating apparatus, this mouth-piece may be covered to retain heat."

Claim.—"Having the pot, where the tea or coffee is prepared, air-tight, and so regulating the heat that is applied to the heating of the same, that a small pressure by the covers prevents it from boiling, and consequently from evaporation, while the tea or coffee is being prepared, in the manner set forth."

34. For an *Improvement in Seed Planters;* Elbridge Marshall, Clinton, N. J.

"The nature of the invention consists, 1st, In operating the distributing device by means of two cams, having two sets or rows of inclined planes placed on concentric circles, for the purpose of causing one of the cams to be operated evenly, in a direction always perfectly longitudinal with the shaft on which it is placed, and thereby preventing any unnecessary friction or binding of said cam upon its shaft. The cam above-mentioned is connected with gearing, by which, upon applying the hand to a crank, the gearing will be operated and said cam turned on the shaft so as to cause the seed to be dropped at greater intervals. 2d, In a peculiar arrangement of the distributing device, by which the seed is dropped with certainty at the proper times, and the apertures in the bottoms of the hoppers and plates prevented from being clogged or choked with the seed."

Claim.—"I do not claim the rotating hoppers with perforated bottoms; neither do I claim any peculiarity in the furrow and covering shares, nor the movable frames to which they are attached, nor the cams, irrespective of their peculiar construction; but what I claim is, 1st, The cams, having two rows or sets of inclined planes upon their faces, said inclined planes being placed oppositely on concentric circles, for the purpose of creating an equal pressure upon the cam, and connecting said cam with suitable gearing, substantially as shown, whereby its position upon the shaft may be changed, and the seed dropped at a greater or less distance apart, whenever the crank is operated or turned by the hand. 2d, The bar, performing, in combination with the circular plates underneath the hoppers, the office of a valve, simultaneously rotating said hoppers by its vibrating motion; the above parts being arranged and operating substantially as described."

35. For an *Improvement in Mills for Grinding Ores, &c.;* W. Ball, Chicopee, Mass.

Claim.—"I am aware that crushing machines have been made, similar in some respects to mine, viz: in the use of balls made to revolve by means of a flat plate or disk, loaded so as to give crushing force to the balls, and to these devices I lay no claim; but I regard my invention and improvement as consisting chiefly in the manner in which I apply pressure to the balls, and the advantages resulting therefrom, and therefore I claim, 1st, The mode described, of applying pressure to the balls, that is to say, making the pressure diagonally or obliquely to the line or axis of the pressing shaft, or obliquely to the vertical diameter of the balls, as a distinct feature from that which is known as the turn-table machine, where the pressure is on the top of the balls, this oblique pressure being effected by the curved central driver, or its equivalent. 2d, The rocking step, in combination with the oblique pressure upon the balls, in the manner set forth. 3d, Making such screen with a conical head, having the lower or conical surface the screening part, for the purpose specified."

36. For an *Improvement in Seed Planters;* Thomas Carter, Laurens District, S. C.

Claim.—"What I claim is, the seed discharging apparatus, in the periphery of the seed wheel, the tube, or apparatus, the escapement wires, and the protecting spring valves, in the manner described."

37. For an *Improvement in Iron Buildings;* Stephen Colwell, Philadelphia, Penna.

Claim.—"What I claim is, the mode of constructing the skeleton walls of buildings of any desired thickness, by placing vertically upon each other, rectangular frames, or hollow squares of cast iron, and sections of the same, like bricks or blocks of stone, but not breaking joints, as in laying brick or stone, the said frames being connected together and leveled, substantially as described, the skeleton wall being separate from the covering of the building, but adapted for receiving on its exterior or interior surface, a covering of plates of iron, or other suitable material, removable at will."

38. For an *Improvement in Sewing Machines;* Samuel J. Parker, Ithaca, N. Y.

Claim.—"What I claim is, that combination that secures to me the relative position in which I place the needle's eye to the movement of the material or feed motion, and the

position of the shuttle and its race resulting therefrom, when the needle is straight and the table on which the material is to be sewn, is horizontal, said relative position meaning the longitudinal axis of the shuttle and its race, at right angles to the feed motion, and the consequent position of the needle's eye therefrom, so that a line drawn through the needle's eye when in the act of passing the centre of the material sewn, shall coincide with the line of feed motion, not be at right angles therewith, and this for the purpose of rendering the stitch more nearly straight and perfect than it otherwise would be, the combination and purpose substantially as described."

39. For an *Improvement in Rat Traps;* Hiram Stafford, Mount Pulaski, Illinois.

"The nature of my invention consists in constructing a rat trap which is provided with a tilting-board, which acts in combination with swinging arms or bars, which constitute the barrier to prevent his escape, and which are acted upon by the animal as he rests his foot on the tilting-board, and causes them to be swung round until they intersect at their points, and thereby prevent his escape in the most effectual manner."

Claim.—"What I claim is, the combination of the tilting-board with the swinging forks and their apparatus, precisely as shown, and for the purpose and in the manner substantially as described."

40. For an *Improvement in Brick Machines;* Thomas E. Seay, Columbia, Virginia.

"My invention consists in the employment of a system of knives, arranged and movable vertically, by a combination of levers and springs, so as to cut the body of the clay from that contained in the moulds; said moulds, and the bricks within them, being at the same time delivered at the top of the machine by the levers operating the knives; the invention also consists in the employment of a grating in the hopper leading to the moulds, by which the clay is screened of stones, and other foreign substances, before being forced into the moulds."

Claim.—"What I claim is, the vertically moving knives, arranged as described, in combination with the levers and slides, whereby the moulded bricks are separated from the mass of clay at the same time that the moulds are raised from their recess, for carrying away and discharging the bricks. Also, the employment of the gratings, as described, between the mill and moulds, for screening the clay from stones and other hard substances, when this is combined with the exterior chamber, into which the stones and other substances are forced by the action of the clay."

41. For an *Improvement in Street Gas Lamps;* William A. Shaw and George Parker, Boston, Massachusetts.

Claim.—"What we claim as a substitute for the stop cock to stop the passage of the gas is, the cap, lined with vulcanized rubber, or other proper material, which cap fits air-tight over the mouth of the burner, as set forth."

42. For an *Improvement in Fish Hooks;* Henry Sigler, Houston, Texas.

Claim.—"What I claim is, making the top portion of the hooks elastic, and so attaching them to the vertical guide piece that they will be made to act as springs for giving action to the hooks, and forcing them together, and also serve with the arms to form a toggle-joint for forcing said hooks apart, and retaining them set for a given time, and in combination with the employing a common bait hook, which is attached to the lower end of the regulating slide, and so situated that its end will be some distance above the ends of the spring-hook, and consequently the fish or animal will have to pass his head between the spring hooks to reach the bait, and in drawing upon which, he will draw the toggle arms out of a horizontal position, and simultaneous therewith operate the spring hooks, which, by there elasticity, are caused to take into the body of the fish and hold it perfectly secure, there being no chance of his escaping, owing to the peculiar action of the hook, it biting harder upon its object when the strain is greatest, substantially as described."

43. For an *Improvement in Machines for Cleaning Cotton;* Charles Leavitt, Quincy, Illinois, Assignor to Sterling R. Cockrill, Nashville, Tennessee.

Claim.—"What I claim is, arranging the several parts involved in extracting the motes, dust, and other impurities, from cotton, previous to and preparatory for ginning the same, substantially in the manner described; that is, combining a wire screen concave, with a revolving wire screen cylinder, or their equivalents, and a wind wheel or fan revolving within the cylinder, both cylinder and concave being armed with teeth set in ribs so distant apart with regard to the teeth as to permit the cotton seed to pass, while the fibre

alone is loosened, the revolving screen running slowly in comparison with the wind wheel, which is driven at a great velocity, thereby adapting the machine to the particular purpose specified, viz: freeing cotton from motes, dust, and other impurities, while attached to the seed, previous to ginning the same."

44. For an *Improvement in Sewing Machines;* James Harrison, Jr., Milwaukie, Wis.

Claim.—"What I claim is, 1st, The combination of the spring, the roller, and the screw, or adjustable pin, operating in the manner described, to prevent the delivery of the needle thread for the successive stitches, until each preceding stitch is drawn to the desired degree of tightness, and then to cause sufficient to be given out for the next stitch, thus regulating the tightness of that part of the stitch formed by the needle thread. 2d, The combination of the drag bar, attached to the shuttle, and containing the eye through which the thread passes therefrom, the spring for throwing the said bar into a position to prevent the delivery of thread from the shuttle, and the adjustable liberating piece, operating as described, for the purpose of preventing the delivery of thread from the shuttle, until after each stitch is finished, and then allowing only the quantity desired to be given out, whereby the tightness of that part of the stitch formed by the shuttle thread, is perfectly regulated. 3d, Constructing the shuttle in two parts, viz: the shell and cap, of which the latter is inserted into and withdrawn from the former, endwise, as described."

45. For an *Improvement in Rat Traps;* Jose Foll, Locust Grove, Ohio.

Claim.—"What I claim is, the combination, as described, of reciprocating and self-locking partitions and floor, in connexion with the weighted crank, which, on the liberation of the catch, alternately opens and closes the entrances of the chambers and of the cell."

46. For an *Improvement in Trusses for Iron Bridges;* George W. Thayer, Springfield, Massachusetts.

Claim.—"What I claim is, the combining or arranging together a series of interlocking and overlapping metallic arched beams, a series of vertical suspension tie bolts, extending from the lower chords to the crowns of the arches of the metallic arched beams, and a series of struts or tie-bolts, extending from the lower to the upper set of chords, the whole, when combined and arranged substantially as set forth, constituting a truss having great strength and advantages, as stated, and made with one long arched beam to extend over and embrace two or more of the arches."

47. For an *Improvement in Reversible Life-Boats;* Nathan Thompson, Jr., Williamsburgh, New York.

"The nature of the first part of my invention consists in an extensible bottom, constructed and applied to a life-boat, substantially in the manner described. And the second part consists in bracing said bottom in such a manner that it will, when in use, apply itself vertically under the cavity of the boat to which it is attached."

Claim.—"I intend to use any known kind of life-boat, provided its bottom be taken out, and then, when my bottom is applied thereto, it will constitute my invention; I do not claim, as of my own invention, a boat whose bottom is secured near the middle of its height or depth, nor one whose bottom slides up and down from the lower to the upper edge of the sides, and vice versa; neither do I limit myself to the use of any special materials in constructing my extensible bottom, or bracing thereto; but I do claim, 1st, The extensible bottom, which may be stowed within the boat, or when in use drop below either side of it, constructed and applied to a life-boat, substantially in the manner and for the purposes described. 2d, I claim, in combination with such an extensible bottom, the diagonal bracing cords, applied in the manner and for the purposes substantially as described."

48. For an *Improved Lubricator;* John Webster, City of New York.

"The nature of my invention consists in the arrangement of having the steam act on the top of the oil as well as below the oil, by which means the oil is not obstructed in its passage by the steam."

Claim.—"What I claim is, The combination of the divided chamber with a three-way cock, one position of which admits oil to the chamber, but shuts off the steam; the other position shuts off the oil and allows the steam to pass from one partition of said chamber to the upper surface of the oil in the other, for the purpose substantially specified."

49. For an *Improved Boring and Mortising Machine;* Henry Allen, Norwich, Conn.

Claim.—"What I claim is, the two adjustable stops, or their equivalents, applied to the

frame or ways that support the feeding carriage, and made to operate in any one of the mortise recesses thereof, the said stops being not only for regulating the amount of movement of the feeding carriage required while a mortise is being made by the boring tool, but also to compensate for the wear of the tool, as stated. Also, the adjustable shifting catch, in combination with the adjustable gauge or slide plate, provided with a recess and screw, as specified, the same being particularly for the purpose of readily centralizing the boring tool, as stated."

50. For a *Combination of Foot Stoves and Lanterns;* F. Arnold, Haddam, Conn.

"The nature of my invention consists in the peculiar method of combining, for many practical purposes, a lamp heating foot stove and a lantern, constructed in such a manner that it will answer the purpose of a foot stove, or a lantern, and convenient for heating any article placed upon its top, for cooking and other purposes."

Claim.—"What I claim is, the movable grate attached to the handle, in combination with the foot stove and lantern, constructed substantially as described."

51. For an *Improved Iron Frame Upright Piano Forte;* Stephen P. Brooks, Boston, Massachusetts.

"The object of my invention is, to improve the tone of the piano by arranging the strings upon an iron frame, with the sounding board directly attached to said frame, without the use of a wooden bed or frame, as heretofore used, or of any other substance between the sounding board and the iron frame, thereby diminishing the cost of the construction of the piano, and also to improve the tone of the upright piano by giving the blow of the hammer upon the strings in a direction from the sounding board, instead of towards it, as heretofore done, and at the same time so to simplify and arrange the action in an upright piano, as to bring it level with, or below the keys, so as to avoid the necessity of casing the top, thereby very materially lessening the expense of the instrument."

Claim.—"What I claim is, an upright piano, in which the iron frame that receives the strings, is curved or arched, so as to prevent the breaking or springing of the said frame by the strain of the strings, and so arranging said iron frame as to make it serve for legs, and the support of the main parts of the instrument, as set forth. Also, placing the whole of the action level with, or below the line of the keys, so as to avoid the necessity of casing the top of the piano, as above set forth. Also, giving the blow to the hammer, and then holding it after the blow is struck by means of the triangular piece and its notch, operating with the rod, substantially as described, and so arranging the action in an upright piano, as to give the blow upon the strings in a direction from the sounding board, as specified."

52. For an *Improved Attachment for Fish Hooks and Artificial Baits;* Julio T. Bull, Whitehall, New York.

Claim.—"What I claim is, 1st, Preventing the points of fish hooks catching in snags and weeds, while trolling, by means of a spring which is attached loosely to a hook or artificial bait, and provided with a stay or support to rest or bear upon whilst sprung against the inner side of the point of the hook. The said spring, by reason of its elasticity, remaining in connexion with the point of the hook, until it is struck by a fish, when it disconnects itself from the point of the same, and allows it to perform its duty, substantially as described. 2d, Arranging a spring catch on the concave side of an artificial bait, for retaining the said protecting spring in its place, and out of the way when not in use, substantially as described. 3d, Providing the lower extremity of artificial baits with a tube which terminates in an eye, so that they may be used with a single or double hook, and with or without the spring protection; the tube serving for the shank of a single hook to be secured in, and the eye for a double hook, substantially as described."

53. For an *Improvement in Dressing Flax and Hemp;* Lewis S. Chichester, Brooklyn, New York.

Claim.—"What I claim is, the combination of the series of twisted or spiral and conical shaped blades on the two rotating stocks, substantially as specified, which, by reason of the twist and conical shape, perform a beating action on the fibres at one end, and gradually change until they perform a scutching action at the other end, as set forth. And I also claim, in combination with the rotating and twisted and conical-shaped blades, the casing which surrounds them and the discharge pipe at one end, to confine and direct the

current of air which is induced, by the rotation of the twisted blades, towards the discharge spout, substantially as and for the purpose specified."

54. For an *Improved Swell Mute Attachment to Piano Fortes;* A. G. Corliss, Portland, Maine.

"The nature of my invention consists in the employment of clamps, so arranged within the instruments, and so controlled by suitable mechanism, that the performer may, at pleasure, cause them to press upon both sides of the bridge and hold it in such a manner as to control the vibration of the sounding board, and thus regulate the tone."

Claim.—"What I claim is, controlling the vibration of the sounding board by means of what I have termed the 'mutes,' which are so arranged and actuated as to be capable, when desired, of pressing upon the bridge with any degree of force necessary to produce the tone desired, as described."

55. For an *Improvement in Door Hinges;* John Elgar, Baltimore, Maryland.

"The effect of this invention is such that when a door, after being opened to the ordinary angle, begins to close, it will receive an impulse that starts it quickly, and then it will be checked and move more gently on the easy part of the descent, until when nearly closed, the steepest or most abrupt part of the inclined joint will come into operation, and bring the door up close shut."

Claim.—"What I claim is, making the joint of door or gate hinges, a series of varied inclined planes or curves, which accelerate and retard, as described, the movement of the door or gate, in closing by its own weight."

56. For an *Improvement in Earth Cars;* Richard H. Emerson, Chicago, Illinois.

Claim.—"I do not claim the invention of a car with hinged or turning flaps in the bottom for discharging earth or other materials; nor do I claim raising or lowering such doors or flaps, by means of a windlass and chains, or of securing them and working them by means of crank shafts and catches; nor do I claim as new, the attachment of a bevel-plate or scraper to a carriage, for the purpose of spreading the earth dropped from the cars, as these devices have all been used before; but what I do claim is, the construction of a long car, arranged as described, with two sets of doors in the bottom, of different breadths, which, in combination with the chains, axles, and crank shafts, and the attached leveling plate, enables me to discharge and spread nearly one-half of the load, without discharging the whole, and to equalize the quantities of earth dropped by disengaging the different sets of doors, which could not be done if the doors were of equal width, and only one-half of them dropped at one time."

57. For an *Improvement in Piano Forte Actions;* Alexander Hall, Lloydsville, Ohio.

"The nature of my invention consists in a peculiar arrangement of the strings, bridges, and action of the piano forte, by which I am enabled to introduce the upper octaves in addition to the normal notes, while playing upon the instrument."

Claim.—"What I claim is, 1st, The arrangement of the bridges of the upper octave strings, in combination with the shifting action, so that the nodal points of these strings may coincide with those of the normal strings, in the manner set forth. 2d, The mode of shifting the action by pivoting the key-board, in combination with the employment of upper octave strings, in the manner set forth. 3d, Making the hammer heads of hard and soft material, for the purpose of playing with effect upon the upper octave and normal strings with the same hammer head."

APRIL 18.

58. For an *Improvement in Brick Machines;* Stephen Ustick, Philadelphia, Pennsylvania; ante-dated November 15, 1853.

"The nature of my invention consists in the employment of a combination of movable and fixed pistons, and movable mould boxes, arranged and operating as described, together with an arrangement for receiving and delivering the moulded brick, and also a combination of devices for lubricating the faces of the pistons after the delivery of each brick, for preventing the adhesion of the clay to said pistons."

Claim.—"I do not claim, in general, the combination of the reciprocating mould boxes, with the stationary and movable pistons; nor do I claim merely feeding the clay through the side of the mould box at right angles to the line of motion of the piston, as these features exist in other machines; but what I do claim is, 1st, The arrangement, substan-

tially as described, of the mould box, with the fixed and movable pistons, whereby, by its motion in the line of motion of the piston, it is made to perform the function of feeding the clay between the pistons, shutting it off from communication with the hopper, and discharging the brick. 2d, The apparatus for receiving and delivering the brick, consisting of the hand, table, and finger, arranged and operating substantially as described. 3d, The arranging on the cam wheel, the oil boxes for lubricating and cleaning the faces of the pistons. 4th, The withdrawing the condensed air from the mould while the pressure is produced by the groove and scraper, or other equivalent devices, substantially as set forth."

59. For an *Improved Circular Sawing Machine;* Stephen Waterman, Williamsburgh, New York.

Claim.—"I do not claim hanging the shaft of a circular saw in a swinging frame moving around a stationary axis; but what I claim is, 1st, Raising the saw shaft by any mechanical means analogous to those described, to bring the collar and nut, or other device by which the saw is secured thereto, to a fixed position above the level of the plane of the top of the carriage, and close under the unsquared portion of the log during the cutting of the slabs from the log, so that the slabs may be cut from a much larger log than when the saw shaft, or the collar and nut, or other device for securing the saw thereto, remains below the level of the plane of the top of the carriage. 2d, Controlling the tension of the driving belt, so that it shall be tight when the saw shaft is in position for cutting, either above or below the log, but slack at other times, by means of the three guide rollers, of which the first two are hung on axis, in arms secured firmly to the rock shaft, and the latter is hung on an axis, in swinging arms, which are held in proper position when the belt is tight, by contact with fixed arms on the shaft, the whole operating as set forth. 3d, A dog, of the lever form described, attached below each or any of the slides by which the log is moved laterally, so that its tooth will project beyond the face of the said slide and under the log, and controlled by a screw through the slide, by which its tooth may be forced upwards into the log when desired, as described."

60. For an *Improvement in Tailors' Measures;* M. T. Rowlands, Pittston Ferry, Pa.

Claim.—"What I claim is, the front, side, and back scales, or their equivalents, constructed and used in conjunction, for the purpose of taking the measures of persons, and cutting garments to fit them, substantially as described."

61. For an *Improvement in Machines for Bleaching Flax;* J. A. Roth and J. Lee, Philadelphia, Pa.

Claim.—"What we claim is, 1st, The employment of a series of combs, for the purpose of sustaining the fibres, constructed and arranged in the manner substantially as described. 2d, The flax or yarn frame, and method of arranging the combs in combination therewith, substantially as described. 3d, The combination of flax or yarn frame and vat, substantially as described."

62. For an *Improvement in Iron Fences;* Matthias P. Coons, Brooklyn, N. Y.

Claim.—"I do not claim any particular device or construction of a post or straining pillar, nor any particular mode of attaching wire or rods to them; but I claim combining a spring bar with the rails, wires, or their equivalents, of metallic fence, in the manner substatially set forth, for the purpose of yielding to pressure or strain arising from change of temperature."

63. For an *Improvement in Machines for Winding and Folding Cloth;* Thomas P. Forsyth, Dalton, Indiana.

Claim.—"What I claim is, the use of the stretcher, in combination with the adjustable guides and slides, and the winding shaft, or the bits, as the case may be, substantially in the manner described."

64. For an *Improved Turning Lathe;* Garret Meldrum, West Philadelphia, Pa.

Claim.—"I do not claim, the mechanical arrangements or combinations for sustaining and communicating a revolution to the machine, as these are common to all lathes; nor do I claim or prescribe any particular kind of tool rest, or cutter, as these are also common; but what I claim is, 1st, The chucks and pinions, with their mandrels passing through the bosses in the chuck plate, in combination with the central spur wheel, substantially as described. 2d, The pawls and their ratchet notches, in combination with the

chucks, substantially as described. 3d, The screw bolt, in combination with the concentric slot in the centre wheel, and the indicator, with the regular divisions, or their equivalents, marked on the wheel, substantially as described; and, 4th, The adjustable tail rest plate, having bosses to correspond with the corresponding bosses in the chuck plate, in combination with the screw mandrels and their jaw nuts, the said tail rest plate being adjustable on the main shaft, substantially as described."

65. For an *Improvement in Spiral Springs for Railroad Cars;* Fowler M. Ray, City of New York.

Claim.—"I am aware that flat, volute, or coiled springs have been applied to carriages, with the weight or force acting in the direction of the volute or coil, the centre of the spring being connected with the running gear and the body of the carriage suspended to the outer end of the coil; from which it follows that the lateral thrusts of the carriage must act incidentally on the spring in or nearly in a line parallel with the axes of the spring; but in such mode of application, the force in that line being merely incidental, the spring is not and cannot be coiled and confined close in a surrounding case, for the play of the spring, being in the direction of the entire freedom between the several coils, is indispensable, and hence the several coils do not mutually support each other, as under my mode of application, in which the coils are in contact, or nearly so, with each other, and thus held by a surrounding or confining case; I do not, therefore, claim the application of force to a flat volute or coiled spring, irrespective of the manner in which the coil is made and confined, so that the several coils shall support each other, on the principle specified. What I claim is, the employment of a flat volute or coiled spring with the outer coil supported by the outer case, substantially as specified, when this is combined with the application of the weight or force to the inner and outer coils, in lines parallel or nearly so with the axis of the spring. And, also, the employment of one or more conical surfaces, or the equivalents thereof, in combination with the coiled spring, substantially as specified, for the purpose of reducing the active length of the spring, as the weight or force applied is increased."

66. For an *Improvement in Machines for Paring Apples;* John D. Seagrave, Milford, Massachusetts.

Claim.—"I do not claim, in general, the device of combining with a paring machine, in which the paring knife moves automatically over the apple, a sliding piece moved automatically in regular alternation with the movements of the knife in such manner as to push the apple from the fork at the completion of the paring, because such device has been used before in the apple parer of Chas. P. Carter, patented Oct. 16, 1849; but what I do claim is, the specific mechanical arrangement for said device, viz: the sheath, made to slide upon the spindle or axis of the fork, and operated by the wire lever, which is impelled at the proper moment by the pin on the wheel."

67. For an *Improvement in Gas Regulators;* G. B. Dixwell, Boston, Mass., and J. A. Dorr, City of New York.

Claim.—"What we claim is, an improvement on the form of gas regulator described as Clegg's, and other similar gas regulators, by disconnecting from the regulating gasometer thereof the surface which is interposed between the main and the branch, and upon which the disturbing pressure of the gas in the main operates, and which, in those regulators, is connected with the regulating gasometer, and connecting the regulating gasometer with a tube, or its equivalent apparatus, which is not disturbed by the varying pressure of the gas in the main, in the manner substantially as described."

68. For an *Improvement in Car Couplings;* Geo. Aulick, Winchester, Va.

Claim.—"What I claim is, constructing a metallic box with vertical grooves, and an inclined trough or slide chamber, and using in combination therewith, a vertically operating valve-like catch, formed with a convex or oval side, and a bevel-like lip or projection, together with a gravitating or self-acting bolt or sliding latch, specifically as described."

69. For an *Improved Box Machine;* Ari Davis, Washington, D. C.

Claim.—"What I claim is, the corner, fastened in the manner described, by forming a mitre joint, and scoring the outside of the box, in the manner described, and fastening the two parts at the corner by the angles of metal, without the use of nails or screws; also, the combination of saws and cutters for forming the joint, as described."

70. For an *Improved Apparatus for Painting Window Blinds, &c.;* Samuel T. Field, Worcester, Massachusetts.

Claim.—"I do not confine myself to any particular devices for holding the blinds or other articles, as they may be varied to a considerable extent; but what I claim is, the mode of painting or otherwise coating blinds, or any other articles, by dipping them in a vessel containing the paint, or other material, and the giving them a revolving motion within a cylinder box or case, to throw off the superfluous paint or material, substantially as set forth."

71. For an *Improvement in Attaching Propellers to the Driving Shaft;* James L. Cathcart, Washington, D. C.

Claim.—"What I claim is, attaching the propeller, secured to a short shaft which passes through the rudder to its main or driving shaft, by an universal joint placed between the stern post and the rudder, by which attachment the propeller is moved laterally with the movement of the rudder."

72. For an *Improved Water Wheel;* G. M. Conner, Charlton, N. Y.

Claim.—"What I claim is, enlarging and contracting the vent or discharge orifice, so as to correspond to the inlet passage, by means of the ring formed of three sections, attached to each other, as shown, and connected to the crank arm of the gate by the lever, as set forth."

73. For a *Machine for Cleaning Blinds, &c.;* G. W. La Baw, Jersey City, N. J.

Claim.—"What I claim is, this machine as original, and the application of it for cleaning doors, blinds, shutters, and panel work generally."

74. For a *Method of Heating, Warming, and Cooking by Gas;* William Boggett and Geo. B. Pettit, Westminster, England; patented in England, Oct. 22, 1851.

Claim.—"What we claim is, making gas burners for heating and cooking purposes, with minute apertures from an inverted or inclined surface or surfaces, substantially as described, so that the upward current or currents of atmospheric air shall be made to impinge and act on the issuing gas at the point or points of issue, on the principle and for the purpose specified. Also, combining with burners constructed and operated on the principle specified, a chamber, through which the gas shall pass to supply the issues, and so located that the flame shall impinge against the surface thereof."

75. For an *Improved Landing Net for Anglers;* Chas. De Saxe, City of New York, Assignor to Thomas H. Bate, Brooklyn, New York.

"The nature of my invention consists in so making the hoop or mouth of the net with proper and convenient joints or hinges, that this hoop may be folded up in a small compass, and thus rendered much more convenient, and less cumbersome, while, at the same time, its strength is not diminished, nor its usefulness impaired."

Claim.—"What I claim is, the construction and arrangement of a landing net in one compact and connected mechanism attached to the staff, made substantially as described, or in an equivalent form, so that it can be folded up upon the staff, or expanded, at the pleasure or convenience of the user."

76. For an *Improvement in Fishing Rods and Floats;* Charles D. Saxe, City of N. Y., Assignor to Thomas H. Bate, Brooklyn, New York.

Claim.—"I am aware that fishing rods have been often constructed so that the different pieces or lengths should slide within each other, and I am also aware that these various pieces have been made of different lengths, the largest one being the longest, so that there would be a space in the largest not occupied by the other lengths; but so far as I have been able to learn, this space has never been rendered useful by converting it into a safe and convenient receptacle for carrying the various implements and contrivances belonging to the angler's art, such as hooks, hackles, leads, swivels, &c. I do not claim the peculiar construction of the rod; but I do claim the combination of the tackle safe with the rod, so that the whole combination forms but a single article, compact, safe, and convenient. Also, the peculiar construction of the float, by which the slightest touch at or interference with the hook causes the line to be suddenly moved or jerked, as if by a quick motion of the hand, and the fish to be thereby hooked, and whether the float is used with the combination set forth, or separately therefrom."

77. For an *Improvement in Potato Washing Machines;* J. H. Fairchild and Sylvanus Richardson, Jericho, Vermont.

Claim.—"What we claim is, the manner of constructing the machine with an outer solid revolving cylinder, for containing water and catching the dirt removed from the roots, and with an inner slatted cylinder, which is secured fast to the outer cylinder, and revolves with it, for removing the dirt and foreign matter from the roots, and discharging them in a clean state at one end of the machine, in combination with the spiral or screw thread, placed in a spiral manner between the two cylinders, for the purpose of separating the dirt from the washed roots, and effecting its discharge simultaneous with the discharge of the roots at the opposite end of the machine, through the passage."

78. For an *Improved Portable Ladder or Fire Escape;* Thomas Armitage, Philadelphia, Pennsylvania.

Claim.—"What I claim is, the mode described, of constructing an extension rescue or ladder, by means of a series of knee-shaped pieces, &c., and a series of rungs of unequal and graduated length, combined and operating in the manner substantially as described."

79. For an *Improved Oyster Knife;* Philos Blake, New Haven, Connecticut.

"My improvement consists in combining with the oyster knife, two parallel cheeks or lips, firmly secured to the shank near the heel of the blade, between which cheeks the nose or thin end of the oyster may be inserted, by a prying or twisting motion broken off, in order to present an opening for the entrance of the blades of the knife."

Claim.—"I am aware that the noses of oysters have been broken in order to give entrance to the knife by inserting them between the tines of a common fork, or other similar instrument, and therefore I do not claim the use of parallel cheeks for this purpose; but what I claim is, combining the said cheeks with the knife in one instrument, whereby the opening of oysters is accomplished with greater ease and expedition."

80. For *Improved Slitting Gauges;* James Ballard, Ashtabula, Ohio.

Claim.—"What I claim is, the slitting gauge head, made in two sections, with or without friction rollers, when said sections are united together at the centre of their length by a pin, or its equivalent, substantially as described. Likewise, the arrangement of the friction rollers, for the purpose described."

81. For an *Improved Faucet;* Richard M. Bouton, West Troy, N. Y.

Claim.—"I do not claim the discovery of any new principle; neither do I claim any of the parts separately considered, as they may have been used for a similar purpose by others; but what I claim is, the combination of the piston, cam, and lever, substantially as described, with or without the toggle joint, for the purpose of closing the valves of liquor faucets."

82. For an *Improved Fly Trap;* David Flanders and Samuel K. Flanders, Parishville, New York.

Claim—"What we claim is, the horizontal circular rotating disk, divided on its upper surface by the ledges into sections, which sections, as the disk rotates, pass underneath a cover of the box, which box contains a wiper that sweeps or traverses over the surfaces of the sections as they pass under the cover, and throws the flies into the box and behind the wiper, the disk and wiper being operated by clock machinery, or its equivalents, as described."

83. For an *Improvement in Grass Harvesters;* Martin Hallenbeck, Albany, N. Y.

Claim.—"What I claim is, the peculiar construction of the fingers described, viz: having ribs at the lower parts of the fingers, and vertical slots passing through the fingers on each side of the ribs and inclined plates attached to the fingers and ledges at each side; the plates preventing the sickle from clogging, and the ledges preventing the grass from being thrown out by the action of the teeth."

84. For an *Improvement in Cleaning Cotton and other Fibrous Substances;* Julius C. Hurd, Medway, Mass.

Claim.—"I do not claim the use of teeth made of pointed wire and secured to the beaters of cotton pickers; neither do I claim the application of springs to the concave of machines for operating upon fibrous materials; but what I do claim is, 1st, The use of the peculiar combing beater described, the teeth being so curved as to bring the beater very near to the feed rollers, and united with each other at their bases, in the manner of

saw teeth, for the purpose set forth. 2d, The peculiar method described, of applying springs to the slats of the grating beneath the beaters, each slat being furnished with independent springs, whereby the moats, as they fall upon the grating, are instantly knocked through the spaces beneath the slats, and are not carried round by the beater to be again entangled with the material, the slats yielding to permit the impurities to pass between them. 3d, The introduction of heated air into machines for picking and dusting cotton, by which a greater uniformity of the numbers of the yarn is obtained, and the material is more thoroughly and readily cleansed."

85. For an *Improved Ticket Box for Railroad Cars;* David A. Hopkins, Elmira, N. Y.

Claim.—"What I claim is, the box, constructed as described, viz: said box having a sliding frame in front, provided with a glass, and having spaces or chambers at its upper part formed by the plates at the back of the frame for the reception of the tickets, the tickets being retained in said spaces or chambers by means of the springs, and forced at the back of the lower part of the box when pressed down from the spaces by means of the springs, as set forth."

86. For an *Improvement in Operating Dumping Cars;* Abram C. Johnson, Meadville, Pennsylvania.

Claim.—"I do not claim transporting earth or other substances, by means of cars attached to a chain passing over pulleys, the chain being endless or otherwise; nor do I claim the arrangement of an upper track above the lower, so that one set of cars may pass above, while the other passes on the lower rails, as this has been done before; but what I claim is, the construction of the balance beams, arranged as described, for the purpose of passing one set of cars over another set, running in an opposite direction on the same track. Also, the arrangement of the rails, and, in combination with that of the car wheels, as described, for the purpose of rendering the cars self-dumping, or any other modification of the same, which may be substantially equivalent to it."

87. For an *Improvement in Cooking Oysters;* Lawson P. Keach, Baltimore, Md.

Claim.—"I do not claim, of itself, cooking by jets of gas applied to the shell or covering of the article of food to be roasted; but I do claim the method described of roasting oysters, or other articles of food having a shell or similar natural covering, by arranging the oysters on supports at a suitable distance apart, for the play of the flame of gas issuing from gas pipes or burners, on or against their shells, when the said burners are so arranged that the flame of the one burner jetting horizontally, or slightly dipping from the horizontal position, impinges and acts upon the top shell of one oyster, and the bottom shell of another, whereby the fish is more thoroughly cooked, and one burner serves for two oysters, as specified."

88. For an *Improved Fire Escape;* Geo. W. Keller, Philadelphia, Pa.

Claim.—"I claim the double chain, in combination with the friction rollers and guards, substantially as set forth."

89 For an *Improvement in Processes for Bleaching Flax;* J. Augustus Roth and Jos. Lea, Philadelphia, Pa.; patented in England, May 26, 1853.

Claim.—"What I claim is, the process of distributing the flax, fibre, or yarn, upon combs, or equivalent devices, and agitating the same when immersed in chemical bleaching solutions, in the manner and for the purpose substantially as described."

90. For *Improved Machines for Filling Match Frames;* A. Sohn, Monroeville, Ohio.

Claim.—"What I claim is, 1st, The combination of the bottomless shaking or reciprocating box or hopper and the fixed bed, which is grooved transversely to the motion of the box, but longitudinally to the direction of the matches, substantially as described, for the purpose of separating a number of matches, and laying them parallel in a row at a required distance apart. 2d, The reciprocating series of rods, in combination as described, with the grooved bed, for the purpose of pushing the matches longitudinally from the grooves into the frame. 3d, Placing the match frame, for the purpose of being filled, in an upright fixed frame, which is furnished with a sliding balanced cross-piece, containing a movable step, which is capable of being protruded through the said cross-piece between the sides of the match frames, and withdrawn therefrom, for the purpose of receiving the slats and matches nearly on a level with the grooved bed, and lowering them into the match frames until the latter are full, and then being withdrawn therefrom to leave the

matches in the frames, and leave the frames free to be taken from the machine, substantially as described."

91. For an *Improved Machine for Opening Oysters;* Wm. H. Towers, Philada., Pa.

Claim.—"What I claim is, opening oysters and other bivalves, without injury to the hands, by firmly inclosing them between jaws, and forcing a knife, having spring guides on its sides, of the form described, between the shells, in the manner set forth."

92. For an *Improvement in Maize Harvesters;* W. Lapham, Executor of Seneca Lapham, deceased, late of Salem, Ohio.

Claim.—"I do not claim the device for cutting the stalks; what I claim is, the method of arranging and operating the reel, that is, hanging the reel on a frame working vertically in ways, and supplied with suitable stops for receiving and discharging, at intervals, the cut maize, substantially as set forth."

APRIL 25.

93. For an *Improvement in Revolving Fire Arms;* Josiah Ells, Pittsburgh, Penna.

Claim.—" What I claim is, the extension on the fore part of the rotating chambered breech, as a prevention of the fouling of the spindle by the smoke in firing, and also as a means of connecting and locking the breech with the barrel, as set forth. The connecting and locking the barrel and breech to the lock, by means of a bracket and spring extending in front of the lock plate, in the manner described. I disclaim originality in the combining of a rotating chambered breech with a barrel and lock, only in the particular manner I have set forth; neither do I use what is called the recoil shield, as such, the collar upon the extension sustaining or preventing the actual recoil of the breech. Also, the use of the vibrating tooth and the spring in the hammer."

94. For an *Improvement in Distilling and Condensing Apparatus;* Jas. R. Stafford, Brooklyn, N. Y.

Claim.—"What I claim is, the employment, for the purpose of separating the more and less volatile products of distillation, of a vessel which has an opening for the escape or withdrawal of condensed matters, and another opening for the escape of the more volatile matters, and which has its temperature regulated by the admission of steam or air through a pipe passing through its interior, or through a chamber surrounding it, substantially as set forth."

95. For an *Improvement in Vinous Fermenting Liquids in Close Vessels;* A. Harvey and C. Guild, Cincinnati, Ohio.

Claim.—"What we claim is, 1st, The application of pumps, or of exhausters and blowers, or other equivalent apparatus, to draw the gas from one fermenting vat, and force it into the fermenting liquid in another or the same vat, as described. 2d, The arrangement of apparatus whereby a return current is created, and the circulation of the gases caused, that is to say, the return pipe and pumps, or mechanism, substantially as set forth. 3d, The check valves, the disseminating pipes, for the purpose of preventing any contrary passage of the liquid from vat to vat, from that which is intended, in combination with the turn-off cocks, for the purpose of isolating a portion of the vats, and shortening the circuit when desired, and the whole in combination with the pumps or valved pistons, for the acceleration of the circulation, and by this means equalizing its action and removing the danger of bursting the vats. 4th, The pipe, having two discharge nozzles at different heights of the liquid of the condensing vat and cocks in the upper nozzle, in order to regulate the amount of vent or discharge."

96. For an *Improved Ditching Plough;* J. C. Tiffany, Coxsackie, N. Y.

Claim.—"What I claim is, 1st, One or more adjustable coulters or cutters, in combination with a permanent coulter, and both in combination with one or more adjustable elevators, with a mould-board or mould-boards attached, substantially as described. I do not claim any of the parts or devices enumerated, separately, or alone, but in combination, and in combination only. 2d, I claim the flexible adjustable spreader, for removing the earth from, or returning it to, the ditch, as required. 3d, The flexible adjustable spreader, in combination with the plough, for the purposes set forth. 4th, The devices, substantially such as are described, or their equivalents, for changing the position of the rear end of the beam, in combination with the angular slot and curved plate, substantially as described."

97. For an *Improvement in Cast Iron Car Wheels;* Geo. W. Glass, Allegheny, Pa.

Claim.—"What I claim is, not the corrugating the disk of cast iron car wheels to render them susceptible of contraction and expansion, nor yet do I claim the making of car wheels with a space between the inner and outer disks or sides, as both these devices are well known, nor the use of core holes in casting car wheels; but what I claim is, the constructing of cast iron car wheels of the shape and conformation described, being wheels with two disks, united at the rim and tread, and at the hub, by a semi-circular or semi-elliptical arch, the greatest external curvature of the inner disk being immediately under the flanch, and below the point of contact of the flanch and tread, for the better supporting the flanch and tread, in combination with the braces, of the construction and shapes shown in the drawings."

98. For an *Improvement in Traveling Bridges;* Frederick Field, Adrian, Michigan.

Claim.—"I do not claim a retractile draw-bridge, nor any of the appliances by which such bridges are moved; my bridge acts as a carriage as well as bridge, receiving its load upon it while resting on the abutments, or one side of the span or spans to be crossed, carries the load over, and rests upon the other side to receive its return load, and so back and forth, leaving the spaces between the piers open for vessels, &c."

99. For an *Improvement in Railroad Car Seats;* Wm. E. Milligan, City of N. Y.

Claim.—"I do not claim the device of making reversible seats, in which the back turns down to form the seat, and vice versa, such having been used before; but what I claim is, supporting the angle of the seat and back upon ways, or in any equivalent manner, whereby it is transferred from one side of the chair frame to the other in making the reversal, substantially as described."

100. For an *Improved Mode of Securing Stones in Foundations;* J. P. Avery, Stonington, Connecticut.

Claim.—"I do not claim the use of dowel joggles of double dovetail form for uniting stone together, as such have before been used; nor yet do I claim making tight the vertical joints, and binding the two courses together by a dowel or key driven through the stone in the course, and into or between the stones in the under course, as such has before been done by wedges let into the ends of the dowel, and serving to spread it to make tight the joints in and between the courses; but I do claim the combination and arrangement specified, of the dovetails and tightening key, or its equivalent, when the said dovetails are constructed of taper flanch form, fitting within or under projecting lips to the dovetail recesses in the stones, to draw and clamp the two courses together, the said dovetails fitting within the one stone of the one course, and the two stones of another course, and being driven home by the intervening key, to make tight the vertical and horizontal joints in the two courses, and to clamp the two courses together firmly and permanently."

101. For an *Improved File or Bill Holder;* Thomas W. Brown, Boston, Mass.

Claim.—"I am aware that spring-boards have been applied to the two boards of a bill or file holder, so as to draw them towards one another, and upon papers interposed between them, and to admit of their being moved apart from one another, such bands having generally been made in whole or in part of india rubber; I therefore do not claim the application of spring bands to the boards; but what I do claim is, the arrangement or application of the circular grooved annulus, a spiral spring and the cords together, and with respect to the two boards, in manner so as to operate substantially as specified."

102. For an *Improvement in Fire Arms;* Chas. Buss, Marlboro', N. H.

Claim.—"What I claim is, the improvement of making the trigger-guard so that it shall not only perform the function of a guard to the trigger, but that of a spring to press the straddler or index holder against the catch wheel, as specified."

103. For an *Improved Rotary Pump;* Reuben Bundine, Washington City, D. C.

"The nature of my invention consists in so combining the action of the screw for delivery of the water into the case or drum, with the revolving arms or ribs formed of involutes of a circle, that by the combined action or effect of these mechanical devices, I am enabled to elevate water at a greatly reduced expenditure of power."

Claim.—"What I claim is, the combination of the screw or screws upon the rotary shaft with the radial curved wings or driver, (although I do not confine myself to the curved form, as straight ones may be used,) the whole contained within a case or drum for receiving and directing the water intended to be elevated in the manner set forth."

104. For an *Improvement in Machinery for Laying Rope;* Stephen Bazin and James A. Bazin, Canton, Mass.

Claim.—"What we claim is, adapting the machinery for forming both 'hard' and 'soft' cordage by means of the ring, so actuated by the circular plate, and its rollers made to revolve or held stationary, as set forth, so as to form an extra twist in the rope when desirable, by giving an additional revolution to the bobbin frames, as described. Also, our improvement in the movable crane, the same consisting in forming it of a bent shape with the right angular hinged arm, operating as described, so as to feed the rope in a direction parallel with the axis of the winding reel. Also, stretching the rope after it is laid, by means of the double pulley with grooves of different diameter, as set forth."

105. For an *Improvement in Feeding Machines for Feeding Sheets of Paper to Printing Presses;* Henry Clark, New Orleans, La.

Claim.—"I do not confine myself to the precise mechanical device described, for that may be modified or varied in many particulars; but what I claim is, loosening or detaching the top sheet of a layer of papers from those underneath it, by giving a part of said sheet a backward and forward motion, as herein shown, previously to its being operated upon by the pressure rollers, or other device of conveying it to the printing press, or other machine to which the sheet of paper is fed, for the purpose of insuring the feed of only a single sheet of paper at a time, as set forth."

106. For an *Improvement in Portable Folding Chair Bedsteads;* Geo. H. Cottam, Hampstead Road, England; patented in England, October 5, 1852.

Claim.—"I make no claim to the parts, separately; nor do I confine myself to the details, as herein given, provided the peculiar character of my invention be retained; but what I claim is, the mode described, of constructing folding sofa or bedstead chairs, viz: of a combination of the frames and jointed arms, as applied and made to operate together, substantially as specified."

107. For an *Improved Wedge Machine;* Geo. C. Jones, of Alna, and Peter King, of Whitefield, Maine.

Claim.—"What we claim is, 1st, The peculiar form of the chisel having two or more projecting chisels at right angles to the face of the main chisel, and an appendage for pushing back the spring, as described. 2d, The application of the spring and its projection, for the support of the wedge while being shaved. 3d, The peculiar form and arrangement of the grooves for holding the blocks to be shaved, and giving shape to the wedges while being shaved."

108. For an *Improved Mode of Operating the Feed Tables of Printing Presses;* Geo. Little, Utica, New York.

Claim.—"What I claim is, the mode substantially as described, of operating the feed tables of printing presses, together with the guides, composed of india rubber or other suitable resisting material."

109. For an *Improvement in Apparatus for Feeding Paper to Printing Presses;* W. Kuhlenshmidt and Wm. Hauff, City of New York.

"The nature of our invention consists in the employment of a semi-circular roller, or its equivalent, so arranged and operated that it will, in its backward movement from the paper cylinder, loosen or detach the top sheet of a layer of paper from those underneath it. and then lift up the back end of said sheet, and in its forward or return movement toward the paper cylinder, feed it to the fingers of the paper cylinder; the said feed roller being provided with some adhesive cement on that part which bears on the back end of the paper for the purpose of perfectly taking up the sheets."

Claim.—"What we claim is, 1st, The employment of a semi-circular roller, or its equivalent, so constructed, arranged, and operated, that it will, in its backward movement from the paper cylinder, loosen or detach the top sheet of a layer of paper from those underneath it, and then take hold of the back end of said sheet, and in its forward or return movement toward the paper cylinder raise the said back end of the sheet, and gradually separate the whole surface of the same from contact with the one under it, and then feed it to the fingers of the paper cylinder, substantially as described. 2d, We claim taking up the sheet by its back end instead of its front end, for the purpose set forth."

110. For an *Improved Field Fence;* Daniel R. Prindle, East Bethany, New York.

Claim.—"What I claim is, the method described, or its equivalent, of fastening together the adjacent posts or standards of a field fence; that is, by passing a piece of metal having a head on one end through two adjacent posts, and securing the same by a wedge, or its equivalent, at the other end, the standards or posts being so beveled as to cause any desired angle to be made by any two adjacent panels."

111. For an *Improvement in Glass Furnaces;* Frederick Schaum, Baltimore, Md.

Claim.—"What I claim is, making the external and internal configuration of the breast-work of the furnace wall with the re-entering portions so as partly to embrace the pots, and to furnish room for additional or extra tease or ring holes, substantially as described."

112. For an *Improvement in Brick Making;* J. C. Fr. Salomon, Washington, D. C.

Claim.—"I claim the combination of the swing crane, mould box, and platen for pressing brick, arranged and operating together, as set forth."

113. For an *Improvement in Forming and Hardening Hat Bodies;* Albert Spencer, City of New York, and Augustus Loeschner, Brooklyn, New York.

Claim.—"What we claim is, the use and arrangement of the series of blow pipes, as substantially set forth, when used in combination with the two or more fan brushes and feeding apparatus, for the purposes set forth."

114. For an *Improvement in Forming Roofs;* W. Sterling, Bridgeport, Connecticut.

Claim.—"I do not claim the application of cements for roofs, or plastering the same on boards or timber, the contraction and expansion of which causes the cement to crack; nor the plastering of cement on lath of any kind whatever, as this has been done before; but what I claim is, the use of reticulated wire imbedded in cement where cloth is used as a foundation, for the purpose set forth."

115. For *Improved Bullet Moulds;* Wm. Montgomery Storm, City of New York.

Claim.—"What I claim is, 1st, A hand bullet mould, so constructed that it may be forced open against the adhesion of the lead, so as to deliver its ball by the pressing together of its handles by the strong grasp of a single hand, whereby are attained the important ends described. 2d, In combination with a mould, constructed as above described, I claim the shears which are operated by the strong grasp of a single hand on the handles, or their equivalents, whereby the ball is deprived of its sprue and released from its matrix by the closing or compressing together of the handles."

116. For an *Improvement in Machines for Cutting and Skiving Boot Counters;* Varanes Snell, North Bridgeport, Massachusetts.

Claim.—"What I claim is, 1st, Arranging the knife at a proper angle in a traversing knife carriage which has a reciprocating motion, in the arc of a circle for rounding the counter and chamfering its edges, substantially as described. 2d, Holding the clamp upon the leather while the counter is being cut, and releasing it from the same after the operation is finished, by means of the traversing pawl, acting in combination with the lever and notched plates, as set forth. 3d, A machine for cutting and skiving boot and shoe counters, which has a clamp for holding the leather while it is being cut, and for releasing it after the operation is performed, and a traversing knife which moves in the arc of a circle, and rounds and skives the counter at the same time, as set forth."

117. For an *Improvement in Oilers for Machinery;* De Witt C. Smiley, City of N. Y.

Claim.—"I do not claim cans having flexible bottoms, as such are well known; but what I claim is, the combination of the interior chamber with the can having a flexible bottom, when said interior chamber has its bottom extended to fill the interior diameter of the can, and form a diaphragm dividing the can into an upper and lower chamber, said diaphragm provided with valves, one opening upward and the other downward, arranged and operating in the manner described."

118. For an *Improvement in Railroad Car Seats;* William B. Thomas and Samuel Hickok, Buffalo, New York.

Claim.—"We claim the combination of railroad car seats with hinged or jointed legs, constructed and operated substantially as described."

119. For an *Improved Syringe Eye Bath;* Simeon Fowle, Pembroke, New York.

Claim.—"I disclaim the invention of a ball, or of a cap, and of elastic cups for cupping; but I claim the combination of the rimmed cap, connected tubularly with ball, and arranged and operating substantially as described, to be used for purposes and in cases as set forth."

120. For an *Improved Re-Action Water Wheel;* Isaac True, Rochester, Indiana.

Claim.—"What I claim is, the employment of the hooked surfaces, and the curved projecting surfaces. in combination with the indented ring, substantially in the manner specified, in the construction of percussion and re-action water wheels, whereby the effective force of the percussion is greatly increased, as set forth."

121. For an *Improvement in Invalid Bedsteads;* C. D. Van Allen, City of New York.

Claim.—"What I claim is, the arrangement and combination of the elevating and depressing bed with the stationary suspension mattress, whereby the bed is raised to and lowered from the patient when necessary, instead of moving the patient, thus avoiding the necessity of moving or disturbing the patient in the least."

122. For an *Improvement in Guard Fingers of Harvesters;* William T. Ketchem, Assignor to Rufus L. Howard, Buffalo, New York.

Claim.—"What I claim is, moulding and casting the blank for the tooth in the open form described, (without a chill,) then mollifying, dressing up, and bending them into the proper shape, as required."

Re-Issues for April, 1854.

1. For an *Improvement in the Cotton Gin;* Jones McCarthy, Orange Springs, Florida; dated July 3, 1840; re-issued April 18, 1854.

Claim.—"What I claim is, the combination of a stripping plate, breast plate, and drawing roll, substantially as set forth."

2. For an *Improvement in Fire and Burglar Proof Safes;* F. C. Goffin, City of New York, Assignor to A. B. Ely, Boston, Massachusetts; dated Feb. 14, 1854; re-issued April 25, 1854.

"The nature of my invention consists in filling the space between the two casings of a safe or door, either wholly or in part, with glass or slag in a vitrified state, for the purpose of rendering the safe or door fire-proof, and also proof against burglars, glass being a poor conductor of heat, and so hard as to prevent the operation of boring or drilling through the sides of the safe or door."

Claim.—"I do not claim forming safes or doors with double casings; but what I claim is, the use of glass or slag in a vitrified state, in the filling of safes or vault doors, either poured moulten into the spaces, or inserted in plates, substantially as described."

Designs for April, 1854.

1. For *Cooking Stoves;* William T. Coggshall, Fall River, Mass.; dated April 18, 1854.

Claim.—"What I claim is, the ornamental design for the side and end plates, the feet and the doors."

2. For a *Door and Panel of Cooking Stoves;* M. C. Burleigh, Great Falls, New York; dated April 25, 1854.

Claim.—"What I claim is, the arrangement and combination of the central ornament with the rays and mouldings."

3. For *Fronts of Clock Cases;* Wm. B. Lorton, City of N. Y.; dated April 25, 1854.

Claim.—"What I claim is, the design and configuration of the plate represented."

4. For *Air-Tight Stoves;* Garrettson Smith and Henry Brown, Philadelphia, Pennsylvania; dated April 25, 1854.

Claim.—"What we claim is, the design, configuration and arrangement of the several ornaments in bas-relief."

5. For *Stove Plates;* John Burgess, Assignor to Geer & Co., Troy, New York; dated April 25, 1854.

Claim.—"What I claim is, the ornamental design and configuration of stove plates."

LAW REPORTS OF PATENT CASES.

Henry O'Rielly, Eugene L. Whitman, and W. F. B. Hastings, *Appellants, vs.* Samuel F. B. Morse, Alfred Vail, and Francis O. J. Smith, *Appellees.*

(Continued from page 338.)

Mr. Justice Grier, Mr. Justice Nelson, and Mr. Justice Wayne dissented; and Mr. Justice Grier delivered the dissenting opinion, as follows:—

I entirely concur with the majority of the Court that the appellee and complainant below, Samuel F. B. Morse, is the true and first inventor of the recording telegraph, and the first who has successfully applied the agent or element of nature, called electro-magnetism, to printing and recording intelligible characters at a distance; and that his patent of 1840, finally reissued in 1848, and his patent for his improvements, as reissued in the same year, are good and valid; and that the appellants have infringed the rights secured to the patentee by both his patents. But, as I do not concur in the views of the majority of the Court in regard to two great points of the case, I shall proceed to express my own.

I.—Does the complainant's first patent come within the proviso of the sixth section of the act of 1839; and should the term of fourteen years, granted by it, commence from the date of his patent here, or from the date of his French patent in 1838?

If the complainant's patent is within the provisions of this section, I cannot see how we can escape from declaring it void. The proviso declares, that "in all cases every *such patent* (issued under the provisions of that section) shall be limited to the term of fourteen years from the date or publication of such foreign letters patent." It is true it does not say that the patent shall be void if not limited to such term on its face; but it gives no power to the officer to issue a patent for a greater term. If the patent does not show the true commencement of the term granted by it, the patentee has it in his power to deceive the public by claiming a term of fourteen years, while in reality it may be no more than one.

But, I am of opinion, that the patent in question does not come within this proviso. The facts of the case, as connected with this point, are these: On the 6th of October, 1837, Morse filed, in the office of the Commissioner of Patents, a caveat, accompanied by a specification, setting forth his invention, and praying that it may be protected till he would finish some experiments necessary to perfect its details. On the 9th of April, 1838, he filed a formal application for a patent, accompanied by a

specification and drawings. On the 1st of May, 1838, the Commissioner informs him *that his application has been granted.* Morse answers on the 15th of May, that he is just about to sail for Europe, and asks the Commissioner to delay the issue of his patent for the present, fearing its effect upon his plans abroad.

On the 30th of October, 1838, he obtained his useless French patent. On his return to this country, in 1840, he requests his patent to be perfected and issued. In his application filed on 9th of April, 1838, there was an oversight in filling up the day and month. This clerical omission was wholly immaterial, but *ex majori cautela*, a second affidavit was filed, and the patent issued on the 20th of June, 1840, for the term of 14 years from its date.

The application of 1838 had a set of drawings annexed to the specification. The second set of drawings required by the 6th section of the act of 1837, being for the purpose of annexation to the patent, they were entirely unnecessary till the patent issued, and are not required by law to accompany the application when first made, and the want of them cannot affect the validity of the application.

In many instances, owing to various causes, the patent is not issued till many months, and sometimes a year or more after the application. The commissioner requires time to examine the specification; he may suggest difficulties and amendments; and disputes often arise which delay the issuing of the patent. But the application does not require to be renewed, and is never considered abandoned in consequence of such delay. It still remains as of the date of its filing for every purpose beneficial to the applicant. The law does not require that the specification and its accompaniments should be in the precise form which they afterwards assume in the patent. It requires only that the application be "*in writing*," and that the applicant should "make oath that he is the original inventor," &c. The other requirements of the act must precede the issuing of the patent, but make no part of the application, and are not conditions precedent to its validity. In the present case, we have, therefore, a regular application in due form, accompanied by a specification and drawings, filed on the 9th of April, 1838. It has not been withdrawn, discontinued, or abandoned. There is nothing in the act of Congress which requires that the patent should be issued within any given time after the application is filed, or which forbids the postponement of it for a time at the suggestion either of the applicant or the officer; nor is there any thing in the general policy of the patent laws which forbids it. On the contrary, it has always been the practice, when a foreign patent is desired, to delay the issuing of the patent here, after application filed, for fear of injuring such foreign application. It forms no part of the policy of any of our patent acts to prevent our citizens from obtaining patents abroad. By the Patent Act of 1793, the applicant must swear that his invention was not known or used *before the application.* The filing of the application was the time fixed for determining the applicant's right to a patent. If a patent had issued abroad, or the invention had been in use or described in some public work *before that time*, it was a good defence to it. The time of filing the application was, therefore, made by law the criterion of his right to claim as *first inventor.*

A foreign patent, subsequent to the date of his application, would not be set up as a defence against the domestic patentee. The American inventor, who had filed his application and specification at home, was thus enabled to obtain his patent abroad without endangering his patent at home. This was a valuable privilege to American citizens, and one of which he has never been deprived by subsequent legislation; and thus the law stood till the act of 4th July, 1836.

Before this time, the right to obtain a patent was confined to American citizens, or those who had filed their intentions to become such. The policy of this act was to encourage foreign inventors to introduce their inventions to this country, but in doing so, it evinces no intention of limiting our own citizens by taking away from them rights which they had hitherto enjoyed. Accordingly, it gave an inventor, who had obtained a patent abroad, (and who was generally a foreigner,) a right to have one here, provided he made *his application* here within six months after the date of his foreign patent. Neither the letter nor the spirit of this act interferes with the right to an inventor, who has filed *his application* here, from obtaining a patent abroad, or his right to a term of fourteen years from the date of his patent.

In 1838, therefore, when complainant filed his application, he was entitled to such a patent. But in March, 1839, an act was passed, by the sixth section of which it is alleged the complainant's rights have been affected. That section is as follows:—"That no person shall be debarred from receiving a patent for any invention, &c., as provided in the act of 4th July, 1836, to which *this is additional*, by reason of the same having been patented in a foreign country more than six months prior to his application; *provided* that the same shall not have been introduced into public and common use in the United States prior *to the application for such patent. And provided also*, that in all cases *every such patent* shall be limited to the term of fourteen years from the date or publication of such foreign letters patent." Now the act of 1836, as we have shown, had given a privilege to foreign patentees to have a patent within six months after date of such foreign patent; it had not affected, in any manner, the right previously enjoyed by American citizens to take out a foreign patent *after filing their application here*. This section gives "*additional*" rights to those who had first taken out patents abroad, and holding out an additional encouragement to foreign inventors to introduce their inventions here, subject to certain conditions contained in the provisoes. Neither the letter, spirit, nor policy of this act, have any reference to, or bearing upon, the case of persons who had first made their applications here. To construe a proviso, as applicable to a class of cases not within its enacting clause, would violate all settled rules of construction. The office of a proviso is either to except something from the enacting clause, or to exclude some possible ground of misinterpretation, or to state a condition to which the privilege granted by the section shall be subjected. Here the proviso is inserted, to restrain the general words of the section, and impose a condition on those who accept the privileges granted by the section. It enlarged the privileges of foreign patentees, which had before been confined to six months, on two conditions: first, provided the invention patented abroad had not been intro-

duced into public use here; and secondly, on condition that *every such patent* should be limited to its term. The general words, "*in all cases*," especially when restrained to "*every such patent*," cannot extend the condition of the proviso beyond such cases as are the subject-matter of legislation in the section.

The policy and spirit of the act are to grant privileges to a certain class of persons which they did not enjoy before; to encourage the introduction of foreign inventions and discoveries, and not to deprive our own citizens of a right heretofore enjoyed, or to affect an entirely different class of cases, when the *applications had been filed here before* a patent obtained abroad.

It is supposed that certain evils might arise by allowing an applicant for a patent here to delay its issue till he can obtain a foreign patent. To which it is a sufficient answer to say, that if such evil consequences should be found to exist, it is for Congress to remedy them by legislation. It is no part of the duty of this Court, by a forced construction of existing statutes, to attempt the remedy of possible evils by anticipation.

I am therefore of opinion that the complainant's patent, as renewed, contained a valid grant of the full term of fourteen years from its original date.

II.—The other point in which I cannot concur with the opinion of the majority, arises in the construction of the eighth claim of complainant's first patent, as finally amended. The first claim, as explanatory of all that follow, should be read in connexion with the eighth—they are as follows:—First—Having thus fully described my invention, I wish it to be understood that I do not claim the use of the galvanic current or currents of electricity for the purpose of telegraphic communications generally; but what I specially claim as my invention and improvement, is making use of the motive power of magnetism, when developed by the action of such current or currents substantially as set forth in the foregoing description of the first principal part of my invention, as means of operating or giving motion to machinery which may be used to imprint signals upon paper or other suitable material, or to produce sounds in any desired manner for the purpose of telegraphic communication at any distances. The only ways in which the galvanic current had been proposed to be used prior to my invention and improvement, were by bubbles resulting from decomposition, and the action or exercise of electrical power upon a magnetized bar or needle; and the bubbles and the deflections of the needles thus produced, were the subjects of inspection, and had no power, or were not applied to record the communication. I therefore characterized my invention as the first recording or printing telegraph by means of electro-magnetism.

There are various known modes of producing motions by electro-magnetism, but none of these had been applied prior to my invention and improvement, to actuate or give *motion* to printing or recording machinery, which is the chief point of my invention and improvement.

Eighth.—I do not propose to limit myself to the specific machinery or parts of machinery described in the foregoing specification and claims, the essence of my invention being the use of the motive power of the electric or galvanic current, which I call electro-magnetism, however

developed, for marking or printing intelligible characters, signs, or letters, at any distances, being a new application of that power, of which I claim to be the first inventor or discoverer.

The objection to this claim is, that it is *too broad*, because the inventor does not confine himself to specific machinery or parts of machinery as described in his patent, but claims that the essence of his invention consists in the application of electro-magnetism as a motive power, however developed, for printing characters at a distance. This being a new application of that element or power, of which the patentee claims to be the first inventor or discoverer.

In order to test the value of this objection as applied to the present case, and escape any confusion of ideas too often arising from the use of ill-defined terms and propositions, let us examine, 1st. What may be patented, or what forms a proper subject of protection under the Constitution and acts of Congress relative to this subject.

2d. What is the nature of the invention now under consideration? It is a mere machine, and subject to the rules which effect a combination of mechanical devices to effect a particular purpose.

3d. Is the claim true in fact; and, if true, how can it be *too broad* in any legal sense of the term, as heretofore used, either in the acts of Congress or in judicial decisions?

4th. Assuming the hypothesis that it is too broad; how should that affect the judgment for costs in this case?

"1st. The Constitution of the United States declares that Congress shall have the power to promote the progress of science and *useful arts*, by securing, for limited times, to authors and inventors, the exclusive right to their respective writings and *discoveries*."

The act of Congress of 1836 confers this exclusive right, for a limited time, on "any person who has discovered or invented any *new and useful art*, *machine*, *manufacture* or *composition of matter*, or any new and useful improvements on any *art*, machine, manufacture, or composition of matter, not known or used by others before his or their discovery or invention thereof, and not, at the time of his application for a patent, in public use," &c.

A new and useful *art*, or a new and useful improvement on any known art, is as much entitled to the protection of the law as a machine or manufacture. The English patent acts are confined to "manufactures," in terms; but the courts have construed them to cover and protect arts as well as machines; yet without using the term *art*. Here we are not required to make any latitudinous construction of our statute for the sake of equity or policy; and surely we have no right, even if we had the disposition, to curtail or narrow its liberal policy by astute or fanciful construction.

It is not easy to give a precise definition of what is meant by the term "*art*," as used in the acts of Congress. Some, if not all, the traits which distinguish an *art* from the other legitimate subjects of a patent, are stated with clearness and accuracy by Mr. Curtis, in his treatise on patents. The term *art* "applies," says he, "to all those cases where *the application of a principle is the most important part of the invention*, and where the machinery, apparatus, or other means by which the principle is applied

are incidental only, and not of the essence of his invention. It applies also to all those cases where the result, effect, or manufactured article, is old, but the invention consists in a new process or method of producing such result, effect, or manufacture." (Curt. Pat., 80.)

A machine, though it may be composed of many parts, instruments, or devices combined together, still conveys the idea of unity. It may be said to be invented, but the term "*discovery*" could not well be predicated of it. An art may employ many different machines, devices, processes, and manipulations, to produce some useful result. In a previously known art, a man may discover some new process, or new application of a known principle, element, or power of nature, to the advancement of the art; and will be entitled to a patent for the same, as an improvement in the art; or he may invent a machine to perform a given function, and then he will be entitled to a patent only for his machine. That improvement in the arts which consist in the new application of some known element, power, or physical law, and not in any particular machine or combination of machinery, have been frequently the subject of patents, both in England and this country, the cases in our books most amply demonstrate. I have not time to examine them at length; but would refer to James Watt's patent for a method of saving fuel in steam-engines, by condensing the steam in separate vessels, and applying non-conducting substances to his steam-pipes; Clegg's patent for measuring gas in water—Jupe *vs.* Pratt: Webster's Pat. Cases, 103—and the celebrated case of Neilson's patent for the application of hot blast, being an important improvement in the art of smelting iron.

In England, where their statute does not protect an art in direct terms, they have made no clear distinction between an art and an improvement in an art, and a process, machine or manufacture. They were hampered and confined by the narrowness of the phraseology of their patent acts. In this country the statute is as broad as language can make it; and yet if we look at the titles of patents as given at the Patent Office, and the language of our courts, we might suppose that our statute was confined entirely to *machines*, notwithstanding in Knoop *vs.* The Bank (4 Washington, C. C. R. 19), Mr. Justice Washington supported a patent which consisted in nothing else but a new application of copper plates to both sides of a bank bill as a security against counterfeiting. The new application was held to be an *art*, and therefore patentable. So the patent in McClurg *vs.* Kingsland (1 How. 204) was in fact for an improvement in the art of casting chilled rollers by conveying the metal to the mould in a direction approaching to the tangent of the cylinder, yet the patentee was protected in the principle of his discovery (which was but the application of a known law of nature to a new purpose) against all forms of machinery embodying the same principle. The great art of printing, which has changed the face of human society and civilization, consisted in nothing but a new application of principles known to the world for thousands of years; no one could say it consisted in the type or the press, or in any other machine or device used in performing some particular function more than in the hands which picked the types or worked the press. Yet if the inventor of printing had, under this narrow construction of our patent law, claimed his *art* as something distinct from the ma-

chinery, the doctrine now advanced would have declared it unpatentable to its full extent as an *art*, and that the inventor could be protected in nothing but his first rough types and ill-contrived press.

I do not intend to review the English cases which adopt the principle for which I now contend, notwithstanding their narrow statute. But would refer to the opinion of my brother Nelson, in 14 How. 177; and will add, that Mr. Justice McLean, in delivering the opinion of the Court in that case, quotes with approbation the language of Lord Justice Clerk in the Neilson case, which is precisely applicable to the question before us. He says, "The specification does not claim anything as to form, nature, shape, materials, numbers or mathematical character of the vessel or vessels, in which the air is to be heated, or as to the mode of heating such vessels." Yet this patent was sustained as for a new application of a known element, or to use correct language, as an improvement in the art of smelting iron, without any regard to the machinery or parts of machinery used in the application.—Such I believe to be the established doctrine of the English courts.

He who first discovers that an element or law of nature can be made operative for the production of some valuable result, some new art, or the improvement of some known art, who has devised the machinery or process to make it operative, and introduced it in a practical form to the knowledge of mankind, is a discoverer and inventor of the highest class. The discovery of a new application of a known element or agent may require more labor, expense, persevering industry and ingenuity than the invention of any machine; sometimes, it is true, it may be the result of a happy thought or conception, without the labor of experiment, as in the case of the improvement in the art of casting chilled rollers, already alluded to. In many cases it is the result of numerous experiments; not the consequence of any reasoning *a priori*, but wholly empyrical, as in the discovery that a certain degree of heat, when applied to the usual processes for curing india rubber, produced a substance with new and valuable qualities.

The mere discovery of a new element, or law, or principle of nature, without any valuable application of it to the arts, is not the subject of a patent. But he who takes this new element or power, as yet useless, from the laboratory of the philosopher, and makes it the servant of man, who applies it to the perfecting of a new and useful art, or to the improvement of one already known, is the benefactor to whom the patent law tenders its protection. The devices and machines used in the exercise of it may or may not be new, yet, by the doctrine against which I contend he cannot patent them, because they were known and used before. Or if he can, it is only in their new application and combinations in perfecting the new art. In other words, he may patent the new application of the mechanical devices, but not the new application of the operative element which is the essential agent in the invention. He may patent his combination of machinery, but not his art.

Where a new and hitherto unknown product or result beneficial to mankind is effected by a new application of any element of nature, and by means of machines and devices, whether new or old, it cannot be denied that such invention or discovery is entitled to the denomination of

a "new and useful art." The statute gives the inventor of an art a monopoly in the exercise of it, as fully as it does to the inventor of a mere machine; and any person who exercises such new art without the license of the inventor, is an infringer of his patent, and of the franchise granted to him by the law as a reward for his labor and ingenuity in perfecting it. A construction of the law which protects such an inventor in nothing but the new invented machines, or parts of machinery used in the exercise of his art, and refuses it to the exercise of the art itself, annuls the patent law. If the law gives a franchise or monopoly to the inventor of an art, as fully as to the inventor of a machine, why shall its protection not be coextensive with the invention in one case as well as in the other? To look at an art as nothing but a combination of machinery, and give it protection only as such against the use of the same or similar devices, or mechanical equivalents, is to refuse it protection *as an art*. It ignores the distinction between an art and a machine; it overlooks the clear letter and spirit of the statute, and leads to inextricable difficulties; it is viewing a statute or a monument through a microscope.

The reason given for thus conferring the franchise of the inventor of an art to his machines and parts of machinery, is, that it would retard the progress of improvement, if those who can devise better machines or devices differing in mechanical principle from those of the first inventor of the art, or, in other words, who can devise an improvement in it, should not be allowed to pirate it.

To say that a patentee who claims the art of writing at a distance by means of electro-magnetism, necessarily claims all future improvements in the art, is to misconstrue it, or draw a consequence from it not fairly to be inferred from its language. An improvement in a known art is as much the subject of a patent as the art itself; so also is an improvement on a known machine. Yet, if the original machine be patented, the patentee of an improvement will not have a right to use the original. This doctrine has not been found to retard the progress of invention in the case of machines; and I can see no reason why a contrary one should be applied to an art.

The claim of the patentee is, that he may be protected in the exercise of his art as against persons who may improve or change some of the processes or machines necessary in its exercise. The Court, by deciding that this claim is too broad, virtually decides that such an inventor of an improvement may pirate the art he improves, because it is contrary to public policy to restrain the progress of invention; or, in other words, it may be said that it is true policy of the courts to refuse that protection to an art which it affords to a machine, and which it is the policy of the Constitution and the laws to grant.

2d. Let us now consider what is the nature of the invention now under consideration.

It is not a composition of matter, or a manufacture, or a machine. It is the application of a known element or power of nature to a new and useful purpose by means of various processes, instruments, and devices, and if patentable at all, it must come within the category of "*a new and useful art.*" It is as much entitled to this denomination as the original art of printing itself. The name given to it in the patent is generally

the act of the Commissioner, and in this, as in many other cases, a wrong one. The true nature of the invention must be sought in the specification. The word Telegraph is derived from the Greek, and signifies to "write afar off, or at a distance." It has heretofore been applied to various contrivances or devices to communicate intelligence by means of signals or semaphores which speak to the eye for a moment; but in its primary and literal signification of *writing, printing, or recording at a distance*, it never was invented, perfected, or put into practical operation, till it was done by Morse. He preceded Steinheil, Cook, Wheatstone, and Davy, in the successful application of the mysterious power or element of electro-magnetism to this purpose; and his invention has entirely superseded their inefficient contrivances. It is not only "a new and useful art," if that term means anything, but a most wonderful and astonishing invention, requiring tenfold more ingenuity and patient experiment to perfect it, than the art of printing with types and press, as originally invented.

3d. Is it not true, as set forth in this eighth claim of the specification, that the patentee was the first inventor or discoverer of the use or application of electro-magnetism to print and record intelligible characters or letters? It is the very ground on which the Court agree in confirming his patent. Now the patent law requires an inventor, as a condition precedent to obtaining a patent, to deliver a written description of his invention or discovery, and to particularly specify what he claims to be his own invention or discovery. If he has truly stated the principle, nature, and extent of his art or invention, how can the Court say *it is too broad*, and impugn the validity of his patent for doing what the law requires as a condition for obtaining it? And if it is only in case of a machine that the law requires the inventor to specify what he claims as his own invention and discovery, and to distinguish what is new from what is old, then this eighth claim is superfluous, and cannot affect the validity of his patent, provided his art is new and useful, and the machines and devices claimed separately are of his own invention. If it be in the use of the words "*however developed*" that the claim is to be adjudged too broad, then it follows that a person using any other process for the purpose of developing the agent or element of electro-magnetism than the common one now in use and described in the patent, may pirate the whole art patented.

But if it be adjudged that the claim is too broad, because the inventor claims the application of this element to his new art, then his patent is to be invalidated for claiming his whole invention, and nothing more. If the result of this application be a new and useful art, and if the essence of his invention consists in compelling this hitherto useless element to record letters and words at any distance, and in many places at the same moment, how can it be said that the claim is for a principle or an abstraction? What is meant by a claim being *too broad*? The patent law and judicial decisions may be searched in vain, for a provision for a decision that a patent may be impugned for claiming no more than the patentee invented or discovered. It is only when he claims something before known and used, something as new which is not new, either by mistake or intentionally, that his patent is affected.

The act of Congress requires the applicant for a patent to swear that "he is the original and first inventor of the art, machine," &c. It requires the Commissioner to make an examination of the alleged invention, "and if it shall appear that the same *has not been invented prior to the alleged invention*, he shall grant a patent, &c. But if it shall appear that the applicant is not the original and first inventor or discoverer thereof, *or that any part of that which is claimed as new had before been invented*," then the applicant to have leave to withdraw his application.

The 13th section treats of defective specifications, and their remedy, where the applicant, through mistake or inadvertency, had claimed "*more than he had a right to claim as new.*"

The 15th section, in enumerating the defences which a defendant may be allowed to make to a patent, states that *inter alia* he may show "that the patentee was not the original and first inventor or discoverer of the thing patented, or of a *substantial and material part thereof claimed as new*," and the proviso to the same section allows the court to refuse costs, "when the plaintiff shall fail to sustain his action on the ground that in his specification or claim is embraced *more than that of which he was the first inventor.*"

The 7th section of the act of March 3d, 1837, specially defines the meaning of the phrase *too broad* to be, when the patent claims more than that of which the patentee was the original and first inventor; and the 9th section of the same act again providing for cases where, by accident or mistake, the patentee claims more than he is justly entitled to, describes it to be, "where the patentee shall have in his specification claimed to be the original inventor or discoverer of any material or substantial part, of which he is not the first and original inventor, *and*, shall have no legal and just right to the same." Thus we see that it is only where, through inadvertence or mistake, the patentee has claimed something of which he was not the *first inventor*, the Court are directed to refuse costs.

The books of reports may be searched in vain for a case where a patent has been declared void, for being *too broad* in any other sense.

Assuming it to be true, then, for the purpose of the argument, that the new application of the power of electro-magnetism to the art of telegraphing or printing characters at a distance, is not the subject of a patent, because it is patenting a principle; yet as it is also true that Morse was the first who made this application successfully, as set forth in this 8th claim, I am unable to comprehend how, in the words of the statute, we can adjudge "that he has failed to sustain his action on the ground that his specification or claim embraces more than that of which he was the first inventor." It is for this alone that the statute authorizes us to refuse costs.

4th. Assuming this 8th claim to be too broad, it may well be said, that the patentee has not unreasonably delayed a disclaimer, when we consider that it is not till this moment he had reason to believe it was too broad. But the bill claims, and it is sustained by proof, that the defendant has infringed the complainant's second patent for his improvement.

The Court sustain the validity of this patent. Why, then, is the com-

plainant not entitled to his costs? At law, a recovery on one good count is sufficient to entitle the plaintiff to recover costs; and I can see no particular equity which the defendants can claim, who are adjudged to have pirated two inventions at once.

I am of opinion, therefore, that the decree of the Circuit Court should be affirmed, with costs.

True copy.

Test: WM. THOS. CARROLL,
C. S. C. U. S.

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

Ratio of Friction to Magnetic Adhesion.

In the January number of the *Annales de Chimie et de Physique*, M. Nicklès, who has been engaged in endeavoring to introduce magnetic adhesion as an element in practical machinery, has given the results of some experiments which he has made on the ratio of the friction to the adhesion.

The electro-magnet used by him was of the kind described by M. Joule, (*Philos. Mag.* 4th Series, Vol. ii, p. 450.) The coils are composed of thirty metres of copper wire of two millimetres in cross-section: each one of the polar surfaces was 0·080 metre long and 0·02 broad. The magnet was placed vertically upon a piece of rail laid with care in a horizontal position. The surfaces were carefully cleaned and polished. A rope passing over pulleys was attached to the upper part of magnet to hold the weights used to determine the separation of the surfaces, and another cord was so arranged as to hold the weight required to produce horizontal motion. The experiments were tried both with the rail dry and wet. The following tables contain the results of the experiments; the weight of the electro-magnet (4 kil.) being added to the pressure; and 1 kil., the weight necessary to produce sliding when the bar was not magnetized, being subtracted from the proper column.

Magnetic	Pressure.		Weight necessary to produce sliding.		Ratio.
Armature dry,	231 kil. 236 229	kil. kil. Mean 232+4=236	73 73 73	Mean 73—1=72 kil.	0·3.
Armature moistened	230 224	227+4=231	63 67 63	64·5—1=63·5	0·27.

After breaking the circuit, a load of 232 kil. was placed upon the magnet, which (as the magnet weighed 4 kil.) gave a total load of 236 kil. The results were as follows:

Armature dry,	Load 236 kil.:	Force to produce sliding 63.	Ratio 0·26.
" moistened,	" 236 "	" " " 59.	" 0·25.

"M. Barral obtained the number 0·31 as the expression of the ratio of friction to magnetic pressure; but as he has not given the details of his

experiments, I do not know whether the slight difference which exists between his results and mine is due to the difference of the processes employed, or to the state of the surfaces in contact. We see, by what has been said, that the moisture of the armature influences the results in either case, and in the same way.

"An accident to the apparatus prevented me from experimenting with the load and magnetic attraction together."

For the Journal of the Franklin Institute.

On the Use of Anthracite Coal in Locomotives.

Being favored with the perusal of the annexed letter, and deeming it of more than ordinary importance in this age of transition from the use of wood to anthracite coal in locomotives, I have obtained the consent of the writer for its publication.

Mr. Pardee being an eminently practical as well as scientific engineer, of long experience in the management of a highly successful coal estate, his statement of facts (not intended for the public eye) proves clearly that there is no great mystery in using anthracite coal for locomotive engines. R.

Extract of a Letter from A. PARDEE, Esq., *to* EDWARD MILLER, Esq., *Chief Engineer of the North Pennsylvania Railroad*

"The use of anthracite coal as fuel, was commenced on the Beaver Meadow Railroad, in 1836, in engines built by Eastwick & Harrison, and has been continued to the present time in a portion of their engines.

"On the Hazleton road we commenced its use in 1838, in the 'Lehigh' engine, built by Eastwick & Harrison, and in 1839 in the 'Hercules,' by same makers. Both engines have been in constant use during the season of navigation, say eight months per year, up to and including 1852, when the 'Lehigh' was taken into the shop to be rebuilt. The 'Hercules' is still in use.

"Both engines had originally copper flues, which were replaced by iron ones after about two years' use, the copper having been worn out at the end next to the fire box, by the particles of coal drawn in by the draft.

"Both engines have now the same fire boxes with which they were turned out of the maker's shop, excepting about one foot of the lower part, which has been once renewed. The iron flues now in use are those put in to replace the copper—never having been renewed either in whole or in part. Altogether, we have in use on this road eight locomotive engines, three built by Eastwick & Harrison, one by M. W. Baldwin, and four in our own shops at Hazleton.

"We have never used other fuel than anthracite coal, excepting for the purpose of kindling fires. The engines have been in use during the season of navigation from two years ago, (when the last were built,) up to the time of the oldest engines named above, and we have never renewed a fire box or set of flues, except the repairs to the two engines named. As

far, therefore, as our experience goes, anthracite coal for fuel is not so destructive to fire boxes and flues as has been generally argued and supposed. We wear out about two sets of grate bars in the season's use of an engine.

"*As to the Character of the Road.*—In starting from the Lehigh at Penn Haven, we had, while using a part of the Beaver Meadow road, an ascending grade averaging 80 feet per mile for 5 miles; then 140 feet per mile for $1\frac{3}{4}$ miles; then 60 feet for $3\frac{1}{2}$ miles, and then a grade of 12 feet per mile for $3\frac{1}{2}$ miles, to the intersection of the various branches leading to the mines. In descending, as you will perceive, mostly by gravity, the coal fire remained entirely inactive, having no artificial draft by fans or otherwise, except that caused by the exhaust steam; while in ascending with a load of empty cars, equal to the whole power of the engine, the fire to generate the necessary steam must be stimulated to the most intense activity; thus making, apparently, a far more unfavorable state of things for the use of coal than on a road where the grades are more uniform, and in consequence, the fire acted upon by a more uniform draft.

"I am aware that it has been said that coal might do for short roads, but that on long roads the continuous intense action of the heat would destroy the fire box and flues.

"Now, it strikes me as absurd to suppose that on a road of any length a fire need be made more intensely hot, or that any part of the boiler could be more heated, than is necessary to drive an engine and full train up ten miles of such grades as are specified above, or that a continuous equable heat for eight or ten hours can be worse than continuing the same heat for an hour, then a moderate fire for an hour, and so on alternately, with the consequent expansion and contraction, and this continued day after day for eight months annually during 15 years.

"I have entered into this subject, perhaps, to a somewhat tedious length, my object being to satisfy yourself and others, that anthracite coal has been used successfully for a series of years in this region as fuel for locomotive engines not differing materially from the ordinary mode of construction."

For the Journal of the Franklin Institute.

Furnaces of Locomotive Boilers. By Zerah Colburn.

In accordance with the principles explained in my article on the above subject, as published in the *Journal* for March, I have designed a boiler of peculiar form, with a view to its introduction upon an important line of road, largely occupied in carrying anthracite coal. The object is that of burning anthracite as a fuel. It is well known to have been the effort of all the parties, who have thus far attempted the adaptation of anthracite to locomotives, to attain to the largest practicable extent of grate surface. The objects sought in enlarging the grate are, to diffuse the action of the draft upon a larger surface of burning coal, thereby lessening the intensity of the fire at any one point; and also, by the same means, to lessen the destructive action of the intense heat upon the sides of the furnace. These objects have been generally appreciated as legitimate

grounds for enlarging the grate, and I have therefore designed my boiler with reference to their attainment.

The boiler referred to has its furnace (rectangular in plan,) placed entirely behind and clear of the driving wheels. The walls of the fire-box, instead of descending perpendicularly from the barrel of the boiler, are inclined outwards sufficiently to give a width of grate as much as the objects contiguous to the track will permit. In the case under notice, the grate, for a gauge of six feet, is *nine feet and six inches* in width. A water bridge, however, of three or four inches width, would probably be run across the furnace in the direction of the length of the engine. With a length, fore and aft, of four feet, which would be extremely convenient for firing, this would allow of 37 square feet of grate area, nearly 50 per cent. more than in the Baltimore built engines.

As this form of furnace requires to be wholly behind the fire box, it might throw the engine considerably out of balance, unless properly lengthened towards the forward end. To lengthen the boiler, however, would increase the friction surface, and consequently the back pressure, in the tubes, thereby requiring an increased action of the blast. But by suitably enlarging the diameter of the tubes, the absolute flue opening is not only made greater, but is made much greater *in proportion* to the friction surface. In the boiler under notice, with a diameter of 51 inches, there are to be 109 tubes, 3 inches in diameter and 16 feet long. The heating surface will therefore stand as follows:

1370	square	feet	tube surface.	
$103\frac{3}{4}$	"	"	fire-box	"
37	"	"	grate	"

This gives one square foot of grate to every 40 feet of heating surface.

As the furnace is very shallow, the heat generated on the grate is received directly upon the crown sheet, from whence it is communicated to the water with less injury to the furnace than if acting upon a deep side sheet.

Some general notes of the engine may be interesting. It is expected to take a load of 300 tons up a grade of 75 feet rise per mile; hence it is planned for considerable power. Inasmuch, also, as the superstructure of the road is of a rail weighing 75 pounds per yard, upon sleepers only 18 inches between centres, it has been determined to place the entire weight of the engine on but six wheels. The dimensions are, therefore, as follows:

Cylinders 20 inches diameter; 24 inches stroke; six drivers, 48 inches in diameter; wheels 12 feet between extreme centres; centres of cylinders (across engine) 8 feet 2 inches apart; boiler 51 inches interior diameter, containing 109 tubes, 3 inches in diameter, and 16 feet long; furnace 4 feet long, 9 feet 6 inches wide, 3 feet 10 inches deep at centre, 12 inches deep at sides; steam ports 14 by $1\frac{3}{4}$ inches; valves of my improved kind, giving a double admission and a double exhaust of steam. Whole weight of engine in running order, estimated at 70,000 pounds.

I am induced to hope, from the adoption of a form of boiler such as I have described, for improved results in burning anthracite coal. By my arrangement, the whole fire is under the reach of the fireman's shovel,

while the entire surface of the grate is nearer the tube openings than by any other plan. Every one engaged in constructing locomotives, will admit that there has been a greater tendency, and, indeed, a greater opportunity, to increase the tube surface than the grate area of locomotive boilers. The difficulty of burning coal upon a small grate has led to its enlargement by longitudinal extension, so that grates of seven feet length are now quite common upon locomotives burning coal. The width of such grates is, however, but three and a half feet, and there is no chance for firing, except on the top, through which the coal is *dumped* in a stack upon the grate. It is very difficult to keep the grates free from cinder, where they are of such length, and consequently they are more apt to become burnt out.

I should propose that in all locomotive boilers, the lower and side tubes be from $\frac{1}{4}$ to $\frac{1}{2}$ inch larger than the others. The draft is strongest at the centre and top of the body of tubes; hence, if the outer and lower tubes are of greater size than the others, more heat will be taken up in them, as the draft will be made easier.

I find that a reaction in regard to the size of tubes is going on in locomotive building. All of the most successful builders are adopting 2 inch, and in some cases $2\frac{1}{4}$, and even $2\frac{1}{2}$ inch tubes, in place of $1\frac{3}{4}$ inch tubes, which have been generally used for some years past. Even with a diminished surface, consequent upon increased diameter, the ability of the boiler to make steam under a given strength of blast, is found to be increased. The grounds upon which this increase has been made, were amply stated in the *Journal* for March.

Electric Induction—Associated Cases of Current and Static Effects. By Professor Faraday.*

Professor Faraday began the season as usual, this place of honor being now generally conceded to him; and upon his favorite subject, it is no wonder that a very numerous assembly came to hear him descant upon "Electric Induction—Associated Cases of Current and Static Effects." It is very singular to notice how new arrangements of well known substances and instruments generate new classes of facts; and it is still more remarkable how the scientific observer stands ready on the watch to catch hold of such facts, and make the most of them. The land electric telegraph was one thing. It turns out that the submarine telegraph is another, just as a plain copper wire passing through the air is productive of certain phenomena when subjected to electric influence, while such a wire coated with gutta percha exhibits still more extraordinary phenomena. The lecturer stated that he had, by means of the great machine employed by the Electric Telegraph Company, proved the truthfulness of the view which he had put forth sixteen years ago (*Experimental Researches*, 1318, &c.), respecting the unusually dependent nature of induction, conduction, and insulation. He had been enabled to experiment with 100 miles of wire. When the wire in the air was experimented upon, not the slightest sign of any of certain effects

* From the London Practical Mechanic's Journal, March, 1854.

upon the galvanometer was produced; with the water wire the action was made evident, yet the wire was equally well and better insulated, and as regarded a constant current, it was an equally good conductor. In consequence of the very accurate manner in which the wire is covered with the gutta percha, a Leyden arrangement is produced upon a grand scale; the copper wire becomes charged statically with that electricity which the pole of the battery connected with it can supply (*Davy, Elements of Chemical Philosophy*, p. 154); it acts by induction through the gutta percha, producing the opposite state on the surface of the water touching the gutta percha, which forms the outer coating of this curious arrangement. The gutta percha across which the induction occurs is only 0·1 of an inch thick, and the extent of the coating is enormous. The surface of the copper wire is nearly 8300 square feet, and the surface of the outer coating of water is four times that amount, or 33,000 square feet. Hence the striking character of the results—results which the best ordinary electric machines and Leyden arrangements cannot as yet approach. The phenomena offer a beautiful case of the identity of static and dynamic electricity, the whole power of a considerable battery being made capable of being worked off in separate portions, and measured out in units of static force, and yet be employed afterwards for any or every purpose of voltaic electricity. The Professor then proceeded to further consequences of associated static and dynamic effects, showing by experimental demonstration many very striking, such as a current of electricity flowing on to the end of the wire, whilst there was none flowing in at the beginning—currents flowing out at both extremities of the wire in opposite directions, whilst no current is going into it from any source—a current first entering into the wire, and then returning out of the wire at the same place. When an iron wire of equal extent is experimented with in like manner, no such effects as these are perceived, proving that, in the former case, time is exactly appreciable. All these results as to time depend upon lateral induction. Admitting that such and similar experiments show that conduction through a wire is preceded by the act of induction, then all these singular phenomena are explained. Mr. Wheatstone had, in 1834, measured the velocity of a wave of electricity through a copper wire, and given it as 288,000 miles in a second. Professor Faraday had, in 1838, shown how it was possible for this to be retarded, and now, with 1500 miles of subterraneous wire, the wave was two seconds in passing from end to end; whilst, with the same length of air wire, the time was almost inappreciable. With these lights, it is interesting to look at the measured velocities of electricity in wires of metal as given by different experimenters:—

	Miles per Second.
Wheatstone, in 1834, with copper wire, made it .	288,000
Walker, in America, with telegraph iron wire, . .	18,780
Mitchell, do do do .	28,524
Fizeau and Gonnelle, copper wire, . . .	112,680
Do. iron wire, . . .	62,600
A. B. G. (*Athenæum*, Jan. 14), copper (Lon. & Bruss. Tel.),	2,700
Do. do. do. do. (Lon. & Edin. Tel.),	7,600

The Professor remarked, that although these effects are so, the conducting power of the air and water wires are alike for a constant current.

Mr. Clarke arranged a Bain's printing telegraph with three pens, so that it gave beautiful illustrations and records of facts like those stated. The pens are iron wires, under which a band of paper, imbued with ferro-prussiate of potassa, passes at a regular rate by clockwork, and thus regular lines of prussian blue are produced whenever a current is transmitted, and the line of the current is recorded.

In the course of the evening, Professor Faraday explained the operation of the Statham fuze which is of the following nature:—Some copper wire was covered with sulphuretted gutta percha; after some months, it was found that a fibre of sulphuret of copper was formed between the metal and the envelope; and further, that when half the gutta percha was cut away in any place, and then the copper wire removed for about one-fourth of an inch, so as to remain connected only by the film of sulphuret adhering to the remaining gutta percha, an intensity battery could cause this sulphuret to enter into vivid ignition, and fire gunpowder with the utmost ease. The experiment was shown of firing gunpowder at the end of eight miles of single wire, and Mr. Faraday stated that he had seen it fired through 100 miles of covered wire immersed in a canal, by the use of this fuze.

For the Journal of the Franklin Institute.

Remarks on the Caloric Ship Ericsson.

The Ericsson having recently been sunk during a trial trip in the harbor of New York, considerable anxiety was manifested by the leading papers of that city at the possibility of her total loss. Their minds were much relieved by the following letter, sent to them for publication, and by which they are assured that as soon as the vessel is again in order, they shall have their promised trial trip; when, it is to be hoped, some of the gentlemen will be able to give a correct account, more consistent with the facts of the case than their report of the celebrated trial trip which finished the days of steam in the winter of 1852.

To the Editor of the New York Tribune.

Sir:—The serious accident to the "Caloric Ship," last Thursday, has deprived me of the anticipated pleasure of inviting you to witness the performance of the new machinery of this ship. Previous to the untoward occurrence, Mr. Kitching had cheerfully acceded to my proposition of making a formal trial trip, this week, to afford the New York Press an opportunity of witnessing the practical operation of the new machinery, and of hearing my explanation of the important changes which have been made in regard to that motive power, which, a year ago, was heralded to the world by the distinguished press of New York, in a manner altogether unprecedented in the history of mechanical progress.

As soon as the ship and machinery are again in serviceable condition, I shall not lose a moment in performing the agreeable task of rendering the proposed account of the invention. In the meantime, I have to state, that when the noble ship went down, the motive power had proved *completely successful.* The engines had not been put to any thing like maximum work, and yet we attained a speed of more than *eleven* miles an hour, with a consumption of fuel which promises to render ocean navigation, in point of economy, what it has already proved in point of celerity.

I am, very respectfully, your obd't. ser't.,

New York, May 2, 1854. J. Ericsson.

The letter of Captain Ericsson is worthy of being placed on record, as showing to what an extent inventors (or those who fancy themselves such) may be carried away with their inventions.

It will be remembered that the *Ericsson* first started with four cylinders of 14 feet diameter, 6 feet stroke, single acting, and the size of the cylinders furnished the substance of many a newspaper article. With those cylinders she made two trials in New York harbor, and one to Washington City, when, from the report of Captains Sands and Ericsson, her large pistons enabled her to maintain an unusual regularity of motion. On her return from Washington, the machinery was all very quietly taken out, and a new set put in, having two cylinders of about 6 feet diameter, 6 feet stroke, double acting; and one of those *expensive* machines, a steam engine and boiler, was actually put on board, to assist in time of need its more powerful brother.

After months of preparation and weeks of tinkering at the packing, a trial trip was commenced, and Staten Island, a distance of seven miles, reached in safety. There the trip was abandoned, and she returned to New York; and then, to my mind, commenced the triumph of genius. Immediately, three steam boilers were ordered and put on board. (I say steam boilers, for they are what is ordinarily built for such, and are used on board the *Ericsson* with water inside and fire in the furnaces.) But you will observe from Captain Ericsson's letter, that he is now using the same motive power that the Press of New York heralded to the world a year since, in a manner unprecedented in the history of mechanical progress.

Is it not a triumph of genius, for a man who has entirely changed his ground still to be able to flatter himself that he is just where he started in principle, but has only been improving his machinery? One more failure, (which is near at hand,) and the old fashioned steam engine will be used, and possibly claimed as a new improvement.

Seriously, however, the *Ericsson* is a most lamentable failure, not yet finished; for the present machinery can never answer a practical use. When the end is reached, I hope that capitalists will cause to be investigated all new inventions that promise large gains, before they allow themselves to be induced to throw away their share of the capital of the country in unproductive and visionary schemes, which only need a practical test on a *moderate* scale to prove their want of merit.

FULTON.

On Electro-Dynamic Induction in Liquids. By Professor FARADAY, F. R. S., &c.*

To Prof. Aug. de la Rive, For. Mem. R. S., &c.

Your question, "whether I have ever succeeded in producing induction currents in other liquids than mercury or melted metals, as, for instance, in acid or saline solutions?" has led me to make a few experiments on the subject; for though I believed in the possibility of such currents, I had never obtained affirmative results: I have now procured them, and send you a description of the method pursued. A powerful electro-magnet of the horse-shoe form was associated with a Grove's battery of twenty pairs of plates. The poles of the magnet were upwards,

* From the London, Edinburgh, and Dublin Philos. Magazine, April, 1854.

their flat end faces being in the same horizontal plane; they are 3·5 inches square and above 6 inches apart. A cylindrical bar of soft iron, 8 inches long and 1·7 inch diameter, was employed as a keeper or sub-magnet: the cylindrical form was adopted, first, because it best allowed of the formation of a fluid helix around it; and next, because when placed on the poles of the magnet, and the battery connexions made and broken, the magnet and also the keeper rises and falls through much larger variations of power, and far more rapidly than when a square or flat-faced keeper is employed; for the latter, if massive, has, as you know, the power of sustaining the magnetic conditions of the magnet in a very great degree when the battery connexion is broken. A fluid helix was formed round this keeper, having 12 convolutions and a total length of 7 feet; the fluid was only 0·25 of an inch in diameter, the object being to obtain a certain amount of intensity in the current by making the inductive excitement extend to all parts of that great length, rather than to produce a quantity current by largeness of diameter, *i. e.* by a shorter mass of fluid. This helix was easily constructed by the use of 8·5 feet of vulcanized caoutchouc tube, having an internal diameter of 0·25, and an external diameter of 0·5 of an inch: such a tube is sufficiently strong not to collapse when placed round the iron cylinder. The twelve convolutions occupied the interval of 6 inches, and two lengths of 9 inches each constituted the ends. This helix was easily and perfectly filled by holding it with its axes perpendicular, dipping the lower end into the fluid to be used, and withdrawing the air at the upper; then two long, clean, copper wires, 0·25 of an inch in diameter, were introduced at the ends, and being thrust forward until they reached the helix, were made secure by ligaments, and thus formed conductors between the fluid helix and the galvanometer: the whole was attached to a wooden frame so as to protect the helix from pressure or derangement when moved to and fro. The quantity of fluid contained in the helix was about ·3 cubic inches in the length of 7 feet. The galvanometer was of copper wire, $\frac{1}{30}$th of an inch in diameter and 164 feet in length, occupying 310 convolutions; it was 18 feet from the magnet, and connected with the helix by thick wires dipping into cups of mercury. It was in the same horizontal plane with the magnetic poles, and very little affected by direct action from the latter.

A solution formed by mixing one volume of strong sulphuric acid and three of water was introduced into the helix tube, the iron keeper placed on the helix, and the whole adjusted on the magnetic poles in such a position, that the ends of the copper connectors in the tube were above the iron cylinder or keeper, and were advanced so far over it as to reach the perpendicular plane passing through its axis: in this position the lines of magnetic force had no tendency to excite an induced current through the metallic parts of the communication. The outer ends of the copper terminals were well connected together and the whole left for a time, so that any voltaic tendency due to the contact of the acid and copper might be diminished or exhausted: after that, the copper ends were separated, and the connexions with the galvanometer so adjusted, that they could be in an instant either interrupted, or completed, or crossed at the mercury cups. Being interrupted, the magnet was excited by the full force

of the battery, and then the *direct* magnetic effect on the galvanometer was observed: the helix had been so arranged that any current induced in it should give a deflexion in the contrary direction to that thus caused directly by the magnet, that the two effects might be the better separated. The battery was then disconnected, and when the reverse action was over, the galvanometer connexions were completed with the helix; this caused a deflexion of only 2°, due to a voltaic current generated by the action of the acid in the helix on the copper ends: it showed that the connexion throughout was good; and being constant in power, caused a steady deflexion, and was thus easily distinguished from the final result. Lastly, the battery was thrown into action upon the magnet, and immediately the galvanometer was deflected in one direction, and upon breaking battery contact it was deflected in the other direction, so that by a few alternations considerable swing could be imparted to the needles. They moved also in that particular manner often observed with induced currents, as if urged by an impact or push at the moment when the magnet was excited or lowered in force; and the motion was in the *reverse* direction to that produced by the mere direct action of the magnet. The effects were constant; when the communicating wires were crossed they again occurred, giving reverse actions at the galvanometer. Further proof that they were due to currents induced in the fluid helix was obtained by arranging one turn of a copper wire round the iron core or keeper in the same direction as that of the fluid helix, and using one pair of plates to excite the magnet; the induced current caused in the copper wire was much stronger than that obtained with the fluid, but it was always in the same direction.

After these experiments with the highly conducting solution, the helix was removed, the dilute acid poured out, a stream of water sent through the helix for some time, distilled water then introduced and allowed to remain in it a while, which being replaced by fresh distilled water, all things were restored to their places as before, and thus a helix of pure water submitted to experiment. The direct action of the magnet was the same as in the first instance, but there was no appearance of a voltaic current when the galvanometer communications were completed; nor were there any signs of an induced current upon throwing the magnet into and out of action. Pure water is too bad a conductor to give any sensible effects with a galvanometer and magnet of this sensibility and power.

I then dismissed the helix, but, placing the keeper on the magnetic poles, arranged a glass dish under it and filled the dish with the same acid solution as before; so that the liquid formed a horizontal fluid disk 6 inches in diameter nearly, an inch deep, and within 0·25 of an inch of the keeper; two long, clean, platina plates dipped into this acid on each side of the keeper and parallel to it, and were at least 5 inches apart from each other; these were first connected together for a time that any voltaic tendency might subside, and then arranged so as to be united with the galvanometer when requisite, as before. Here the induced currents were obtained as in the first instance, but not with the same degree of strength. Their direction was compared with that of the current induced in a single copper wire passed between the fluid and the

keeper, the magnet being then excited by one cell, and was found to be the same. However, here the possibility exists of the current being in part or altogether excited upon the portions of the wire conductors connected with the platinum plates; for as their ends tend to go beneath the keeper, and so *into* the circuit of magnetic power formed by it and the magnet, they are subject to the lines of force in such a position as to have the induced current formed in them; and the induced current can obtain power enough to go through liquid, as I showed in 1831. But as the helix experiment is free from this objection, I do not doubt that a weak induced current occurred in the fluid in the dish also.

So I consider the excitement of induction currents in liquids not metallic as proved; and as far as I can judge, they are proportionate in strength to the conducting power of the body in which they are generated. In the dilute sulphuric acid they were of course stronger than they appeared by the deflexion to be, because they had first to overcome the contrary deflexion which the direct action of the magnet was able to produce; the sum of the two deflexions, in fact, expressed the force of the induced current. Whether the conduction by virtue of which they occur is electrolytic in character or conduction proper, I cannot say. The present phenomena do not aid to settle that question, because the induced current may exist by either the one or the other process. I believe that conduction proper exists, and that a very weak induction current may pass altogether by it, exerting for the time only a tendency to electrolysis, whilst a stronger current may pass, partly by it and partly by full electrolytic action.—*Bibliothèque Universelle de Genève.*

Royal Institution, March 7, 1854.

On the Spheroidal State of Water in Steam-boilers. By A. Normandy, Esq.*

To Dr. Tyndall, F. R. S., &c.

Convinced as I am that water frequently assumes the spheroidal state in boilers, in consequence of which these most important vessels, on which the very existence of the steam engine, that is, of most of the comforts of civilized life, depend, are too often converted by mismanagement or ignorance into frightful engines of death and destruction, I venture now to trouble you with a few observations in addition to those which you were kind enough to listen to the other day, in the hope that, should the facts which I am about to relate appear to you as conclusive as they do to me, you may be induced, in your lectures on heat, to call once more the attention of the audience, should you deem fit to do so, to this, I believe, fruitful but almost unsuspected, or at any rate scarcely credited source of explosion.

I have already had the honor to relate to you that I had seen the plates of a Cornish boiler, a quarter of an inch thick, become red hot in the flue, although at the time the boiler contained its due quantity of water. It was a new boiler, about 18 feet long; and that the water had assumed therein the spheroidal state is proved by the fact, that a lead rivet, 1 inch

*From the Lond., Edinb., and Dublin Philosoph. Magazine, April, 1854.

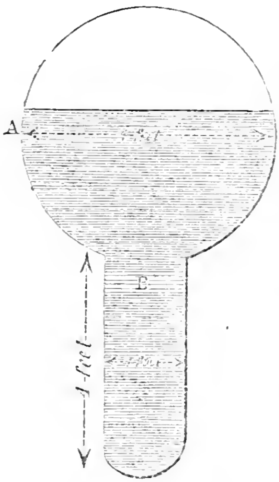
in diameter, put in for safety, was actually melted. It is, in fact, this rivet which led to the detection of the cause of the occurrence, and an investigation of the subject brought out the following details. The fireman or stoker was an ignorant mulatto, who having noticed the lead rivet in the boiler, had given it as his opinion that it would soon be melted by the fire; the possibility of such an accident having been denied by one of his fellow workmen, a bet had taken place between them. The wager having thus been laid, the fireman set to keeping up a brisk, bright fire; in consequence of which, steam being generated exceedingly fast, *priming*, that is, a production of steam under the superincumbent water, took place, and, as a matter of course, the water, or a portion thereof, not being any longer in contact with the surface of the iron plate, the latter in a very short time became red-hot, and *the rivet melted;* for some time afterwards, however, the water being in the spheroidal state, the boiler remained apparently sound, that is, it did not leak, although it had an opening of an inch diameter left in consequence of the melting of the rivet; it is only shortly afterwards I was told, that the heat having diminished, torrents of water poured through the hole with almost explosive violence, emitting volumes of scalding steam as it came in contact with the fire on the grate.

This took place at the Wenlock Timber Saw-mills; and I can bear testimony to the above fact, and likewise to this circumstance, that when filled as usual with its normal quantity of water, the bottom of the boiler over the fire could, in the course of five or six minutes, be made red-hot at pleasure by brisk firing. In fact, having called at the above works, according to appointment, to meet the engineer there, my inquiry as to the then state of the boiler was answered by the foreman, in presence of his master, in these words:—"*The boiler is not red-hot now, but if you will step this way it will be made so immediately;*" and in spite of all remonstrance as to the danger of such an experiment, he came shortly afterwards to announce that the boiler was red-hot, and *I saw it* in that state in presence of the engineer, the master, his nephew, the foreman, and the fireman or stoker. The production of steam had been thereby spontaneously reduced, the bolt or lead rivet eventually melted, but not in my presence; for seeing the state of things, I speedily retreated with the engineer and the master, but almost reluctantly followed by the foreman, in whose somewhat jeering looks I could plainly read that he entertained but a poor idea of our pluck.

In addition to this, I may say that in "wagon boilers," a shape than which none can be more unsafe, but which is now fortunately much less in use than in former years, bulging bumps are very often observed, which are certainly due to the pressure of the steam in the boiler upon the iron plates of the bottom, when by extravagant or incautious firing they have been made red-hot. Frequently, however, instead of bulgings or bumps being thus produced, a disruption of the boiler takes place, attended with more or less fatal consequences. Many such accidents have thus happened at Manchester, and particularly on Monday mornings.

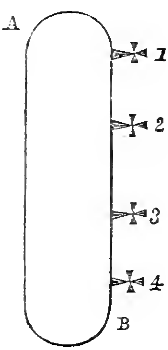
The following occurrence, related to me by my friend Mr. A. M. Perkins as having taken place *in his presence* in a boiler of a peculiar construction in which steam was generated by means of his hot-water pipes,

is also well worth mentioning, as I think we may gather from it a correct explanation of the facts under consideration; and the rough sketch below, which represents a cross section of the boiler, will perhaps explain the matter better than I could do by writing.



The boiler had the dimensions indicated, and was 8 feet in length; it was filled with water to about A as usual, the safety valve had an area of 4 inches. From such a boiler the whole of the water was completely driven off through the valve by violent *priming;* that is to say, steam was generated so fast by a hot water pipe in the limb B, that it completely lifted up the water and violently squirted it out of the boiler, as just related. In such a case, the water being heated by pipes, and not by contact with the heated surfaces of the boiler, no other mischief could result than that of priming: but suppose, on the contrary, such a boiler to have been heated in the usual manner; there is no doubt that the steam generated in the limb B would, by lifting the superincumbent water, have soon permitted that part of the boiler to become red-hot, and thus have procured the curious phenomenon *revived* and *studied* by Boutigny d'Evreux, and named by him a fourth or spheroidal condition of matter, but to which, so far as refers to water, the late Jacob Perkins had, to my certain knowledge, called the attention of engineers and of savans more than twenty-five years ago, (in fact, as far back as 1824.)

Allow me to relate also the curious experiment of a distinguished civil engineer, Mr. Alexander Gordon, made several years ago, as related to me by Mr. A. M. Perkins. A B is a cylinder provided with four try-cocks, 1, 2, 3, 4; water being introduced into the cylinder and heated therein, the cocks on being successively turned gave the following results; namely, steam issuing from 1, 2, 3, and water from 4; but after urging the fire, the above order was found to be completely reversed; that is to say, cock No. 1 emitted water, and cocks Nos. 2, 3, 4 steam.



These facts, in my humble judgment, appear to me to prove in a decided manner,—

1. That the heating of surfaces previous to the introduction of water is not necessary to produce the spheroidal state.

2. That many boiler explosions may be referable to that condition.

3. That all boilers which offer an extensive surface to the heat, that is to say, all boilers with internal flues, are pre-eminently liable to explosions from this cause.

Earthy deposits in all kinds of boilers are favorable to the production of this dangerous phenomenon.

I cannot terminate this informal letter without apologizing for having so long trespassed on your valuable time and patience; but if a collection of facts be essential to the progress of science, I hope that you will indulgently receive this communication.

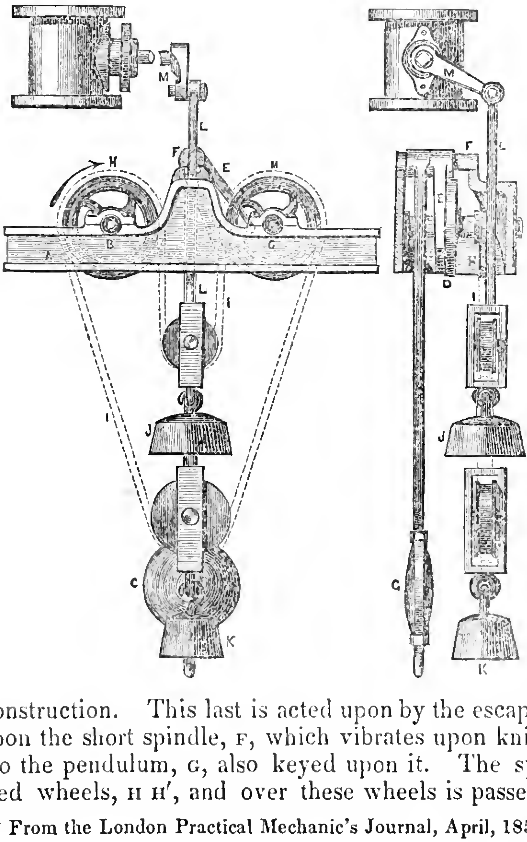
67 *Judd Street, Brunswick Square, March* 20, 1854.

---

*Moison's Pendulous and Rotary Governors.**

The two classes of "Pendulous and Rotary Governors" of M. Moison, are ingenious combinations of regulating apparatus on a principle quite distinct from anything hitherto adopted in this country. The inventor's pendulous governor is represented in front elevation in fig. 1, and in vertical transverse section in fig. 2. In bearings in the rectangular open framing, A, are supported two short horizontal spindles, B C, the former having keyed upon it a pulley, by means of which it receives motion from the prime mover, and the latter carrying an escapement wheel, D,

Fig. 1. Fig. 2.



of simple construction. This last is acted upon by the escapement arms, E, keyed upon the short spindle, F, which vibrates upon knife edges, in obedience to the pendulum, G, also keyed upon it. The spindles, B C, carry toothed wheels, H H′, and over these wheels is passed an endless

* From the London Practical Mechanic's Journal, April, 1854.

pitch chain, I, to which are suspended the two weights, J K, by means of anti-friction pulleys. The weight, J, is suspended to a portion of the endless chain, I, which hangs down between the two wheels, H H′, and is connected by the rod, L, to the lever, M, of the throttle valve; the other weight, K, serves to keep the endless chain stretched. The wheel, H, is made to revolve at a uniform rate by the action of the pendulous escapement, the various parts and connexions being so proportioned that this rate shall correspond to the rate at which it is wished to maintain the machinery. The maintaining power for the escapement is derived from the wheel, H, by means of the endless chain, I. The wheel, H, revolves in the direction of the arrow, so that, if it goes at a quicker rate than the

Fig. 3.

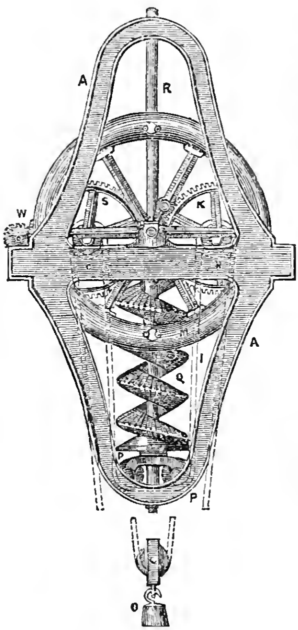
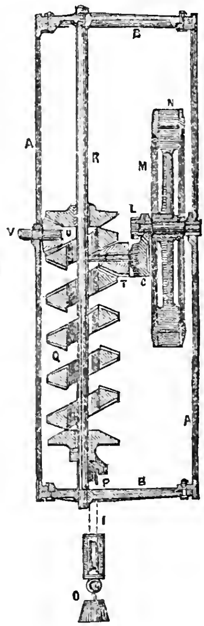


Fig. 4.

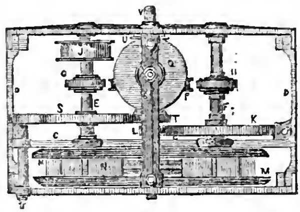


wheel, H′, it will deliver the chain faster than the latter will take it up, so that the weight, J, will descend, and by pulling down the rod, L, cause the throttle valve to partially close; and if the motion of the wheel, H, is rendered slower by any means, the reverse action will take place, and the throttle valve will be opened.

M. Moison's rotary governor is represented in front elevation in fig. 3, in transverse vertical section in fig. 4, and in plan in fig. 5. The apparatus is contained in a framing consisting of the front and back standards, A, and the top and bottom tie plates, B. There is also a central horizontal bar, C, serving to support portions of the mechanism, and which bar is cast in one piece, with two lateral cross bars, D, fitted to the front and back standards. Upon two spindles, E F, turning in bearings in the back frame, A, and central bar, C, are keyed the toothed wheels, G H, over

which passes the endless pitch chain, I. On the spindle, E, is keyed a pulley, J, by means of which motion is communicated to the mechanism from the prime mover to be regulated. On the spindle, F, is keyed a spur-wheel, K, in gear with a pinion, L, fast on a short spindle turning in bearings in the central frame-piece, C, and front frame-piece, A. The last-mentioned spindle carries a fly or vane wheel, M, fitted with a number of blades, N, set on pivots. These blades are acted upon by springs, so as to have a tendency to maintain a tangential position, in which they meet with the least atmospheric resistance in revolving. They are so poised, however, that the centrifugal force due to the revolution of the wheel will cause them to assume various inclinations according to the velocity. The arrangement is such, that, at the regular working rate, they are inclined midway between a tangential and a radial position, so that, if the velocity increases, they become more nearly radial, and cause a greater atmospheric resistance; and if the velocity diminishes, the reverse takes place, and by their becoming more nearly tangential, they reduce that resistance. In this manner the rate of the wheel, M, is never altered to the full extent of any change in the rate of the prime mover, so that, when such change of rate takes place, an inequality is occasioned in the velocity of the wheels, G and H, and the former delivers either more or less of the chain than is taken up by the latter, so that the portion of chain hanging down between the two wheels is increased or diminished according as the rate of the prime mover is accelerated or retarded. This regulating movement may be communicated to the throttle valve of a steam engine, in the same manner as in the governor already described. In figs. 3, 4, and 5, however, a different arrangement is shown, and one which is designed to act upon the sluice-gate of a hydraulic prime mover, where considerable altering power is required.

Fig. 5.



The outer portion of the endless chain, I, is kept stretched by the weight, O, as in the previous arrangement; but instead of the weight, which is suspended to the inside portion of the chain, and is directly connected to the lever of the throttle valve in that arrangement, this inside portion of the chain passes round two pulleys, P, in a bracket acting as a support to the toothed and duplex bevel helix, Q. This helix revolves upon the vertical shaft, R, fixed to the top and bottom tie plates, B, of the framing; the pulleys, P, however, and their bracket, are prevented from turning on the shaft, R, by means of a groove and feather, whilst the helix and pulleys can rise and fall on the shaft, being in fact suspended in the endless chain, I. Upon the spindle, E, is keyed a spur wheel, S, in gear with a pinion, T, carried loosely on a stud pin in the central bar, C. This pinion, T, is cast in one piece, with a bevel wheel lying within the range of the toothed helix, Q. The bevel wheel, T, is of such a size as to be just clear between the under side of one convolution and the upper side of the next lower convolution of the helix. It follows, from this arrangement, that, on the slightest up or downward movement of the helix, Q, due to the increase or diminution in length of the portion of the endless chain by which it is supported, consequent on any altera-

tion in the rate of the prime mover, as already explained, this helix will come into gear either with the top or bottom side of the bevel wheel, T; and as this wheel is constantly revolving, it will cause the helix to revolve in one direction or other, as the case may be. This rotary movement the helix communicates to a bevel wheel, U, on the opposite side of the helix to the bevel wheel, T. This last-mentioned bevel wheel is fast upon a shaft, V, which works the sluice gate by means of a rack and pinion, or in any other convenient way. Thus, the actual power of the prime mover opens or shuts the valve, the governor simply serving to bring the various parts into gear when any alteration is called for. This last described contrivance is obviously applicable to the pendulum governor previously described. The pinion, S, gears with a pinion, W, on a short spindle, with a squared end to receive a winch handle, by means of which the sluice is opened sufficiently to start the apparatus; and the vane wheel, M, is fitted on its spindle with a ratchet wheel and spring pawl, so as not to affect the revolution of the spindle whilst the machinery is being started. When the helix is in the position represented, the sluice will be quite shut, and, on the machinery being set in motion, it will rise and open the sluice more and more, until the desired speed is attained.

Prevention of Smoke and Economy of Fuel practically proved. By Mr. J. J. Stevens, Assoc. I. C. E.

[Extract of Report to the Board of Health.]

"The patent of Mr. John Lee Stevens (who I should observe is no relative of mine), appears to meet the case in a manner that is more in accordance with the opinions I have entertained than any other I have seen; in so much as it is extremely simple in its details, is consequently inexpensive as regards the first cost, requires no motive power to work it as in the case of Juckes' plan, also of Hazeldine's, and Samuel Hall's; and hence it is applicable to every description of furnace, and even to bakers' ovens.

"The operation is as follows:—At the far end of the furnace is placed a supplementary bearing bar, under which, at a few inches from the upper fire bars, is a small grating, upon which a portion of incandescent fuel falls from the furnace beyond the supplemental bearing bar; and at the end of the furnace there is an opening in which is placed two plates, protruding into the furnace, with an opening between them for the admission of air. The oxygen of the atmosphere passing through the ash-pit, over the grid plate, and between the two caloric plates, becomes heated, and in that state comes into contact with gases passing off from the body of the furnace, and so combining with the carburetted hydrogen, ignition is produced, and the flame carried along the flues in place of the black smoke.

"To convey my observations to you more fully I send you a copy of my notes as taken at several of the manufactories I have visited, viz.:—

Mr. J. C. Preller, patent leather manufactory, Lant street, Borough.

"Boiler 12 feet × 4 feet, with internal flue; coals used, Midland and Newcastle; consumption, $2\frac{1}{2}$ tons per week. I had the furnace charged

* From the London Mining Journal, No. 964.

with coals in the usual way, and observed the top of chimney; saw brown semi-opaque smoke during the time the furnace door was open. As soon as the door was closed the brown smoke immediately became transparent. I then had the coals raked up, and a further supply thrown on, but found the stoker *could not* produce black opaque smoke. The engineer stated that the saving in coals, the additional work now performed by the engine considered, was about one-third; that they were compelled, with the old furnace, to resort to Welsh coals (anthracite), as the volume of black smoke with Midland or Newcastle coals then caused great complaints in the neighborhood; and that the cost of Welsh coals compared with the Midland, and considering the saving above referred to, between the old and new furnaces with Midland coals, made an advantage to the proprietor of more than 40 per cent."

Messrs. Easton and Amos, engineers, Grove street, Guilford street, Southwark. "Boiler 18 feet × 6 feet, with J. Lee Stevens's furnace, and boiler 14 feet × 5 feet, Juckes's furnace; consumption of coals, nothing but slack being used, about $2\frac{1}{2}$ tons per day; the flues of the two furnaces conducted into one shaft; and the first mentioned furnace fed with coals about six times per hour. Brown semi-opaque smoke emitted $1\frac{1}{2}$ minutes after coaling; light brown, nearly transparent, for another minute; and afterwards only a thin vapor, slightly tinged, not so much as from an ordinary house fire. With Juckes's patent the fire has to be drawn back about twice in each hour, during which time semi-opaque smoke is emitted for two minutes. The working of these two plans in juxta-position is very satisfactory as regards the merits of each of them. The stoker states that he gets up the steam to the required pressure with much greater facilities since he has had Mr. Lee Stevens's arrangement of furnace. Before its introduction, dense black smoke was emitted from the chimney for 40 minutes out of every 60."

Mr. Sisterson, engineer, Bridge street, Southwark. "A very small boiler and furnace. Boiler 6 feet 6 inches × 3 feet 9 inches; consumption 2 cwts. per day. When Mr. Lee Stevens's smoke-consuming apparatus was applied, the furnace was contracted, and the saving of coals is one-third : formerly the dense black smoke was very much complained of; but since the adoption of the new plan there is no cause for complaints; and the fireman stated that they got up steam with greater facility, and that, combined with the saving in coals, would render a return to the old principle a loss to them."

Messrs. Keens and Welch, Mustard Mills, Garlick hill, City. "Having complaints from their neighbors of the volumes of black smoke emitted from the engine-chimney, and having been served with a notice from the authorities in the City to abate the nuisance, they had adopted Mr. Lee Stevens's furnaces. Boiler 13 feet × 5 feet 6 inches; saving of fuel $\frac{1}{12}$th; the fire surface unusually large. Had previously an ordinary furnace, charged four times per hour; dense black smoke emitted for 10 minutes after firing, 40 minutes per hour. With the new plan, charge four times per hour; brown semi-opaque smoke emitted $1\frac{1}{2}$ minutes, or 6 minutes per hour. The engineer states that he has had less difficulty in getting up the steam; that he has recommended the proprietors to have

the furnace of the second boiler altered so as to consume the smoke; and that it would be a loss to them to return to the old plan."

At another of Messrs. Keens and Welch, Trinity lane, City. "The stoker reported the saving of fuel was one-fifth, and that with this smoke-consuming apparatus he can get up the steam in less time than before. There was no smoke perceptible from the top of the chimney, except when the furnace door was open, and then not black, but brown semi-opaque. Previous to the adoption of Mr. Lee Stevens's apparatus there were great complaints in the neighborhood of the smoke from this chimney."

Messrs. Miller, Ravenhill, and Salkeld, engineers and marine steam engine manufacturers, Glasshouse field, Stepney. "Boiler 11 feet $\times$ 4 feet; consumption of coals $8\frac{3}{4}$ cwts. in 12 hours. With old furnace they charged every 10 minutes, which gave thick black smoke for five minutes, and then brown smoke for the remaining five minutes. With Mr. Lee Stevens's plan, charged the furnace every quarter of an hour, the smoke being without color as soon as the furnace door was closed. The result of a continuous use of the invention, as regards consumption of coal, was—Old plan, $3\frac{1}{2}$ tons, consumed in 7 days 2 hours; new plan, $3\frac{1}{2}$ tons, consumed in 8 days $5\frac{1}{2}$ hours; estimated saving about a sixth. As this eminent firm had been mainly desirous of testing the value of Mr. Lee Stevens's invention as regards the saving of fuel, they gave me the opportunity of trying an experiment in reference to the consumption of smoke, which was as follows: The hot-air passage at the end of the ash-pit, and through which the air is admitted into the back of the furnace, between the caloric plates before described, I had stopped with clay; by which means the furnace was temporarily restored to the ordinary or old plan, the result of which was the production of a large volume of thick black smoke, nearly continuous; but on the removal of the clay the black smoke immediately subsided, and the vapor exuding from the chimney was scarcely perceptible, the beneficial action of the invention being instantly restored. This experiment was very interesting and satisfactory, as it exemplified at once the facility with which the smoke may be consumed. Mr. Salkeld, one of the firm, stated that he would not be disposed to return to the old plan of furnaces, but that he would, in setting new boilers, be disposed to adopt smoke-consuming apparatus; and from the experiments that had been tried on the premises, he would give the preference to the plan of Mr. Lee Stevens, which he was then having applied to another boiler." "I have visited several other establishments, but the results are so similar to the above in general statistics that only one other need be mentioned, that of—

Mr. W. R. Shaw, leather manufacturer, Wyld's rents, Bermondsey. "At this place I found they consume such refuse as tan, leather shavings and cuttings, &c., with about one-fourth of coal. The smoke arising from such fuel was not only dense, but the odor was extremely disagreeable when burnt on the old plan of furnace; but by the adoption of the smoke-consuming apparatus of Mr. Lee Stevens, the opacity of the smoke was removed, and the smell also—the gases being more perfectly converted to the production of heat."

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, May 18, 1854.

John P. Parke, Esq., President, pro. tem., in the chair.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from John T. Clark, Esq., Albany, N. Y.; The Lyons Manufacturing Co., City of N. York; Thos. Ewbank, Esq., Washington City, D. C.; G. H. Hart, Esq., Penna. Legislature, and from Messrs. Chas. Ellet, Jr., Fred. Graff, J. D. Whitney, Foster & Whitney, Dr. L. Turnbull, Lieut. Jas. H. Bulkley, and Samuel Sloan, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer read his statement of the receipts and payments for April.

The Board of Managers and Standing Committees reported their minutes.

On motion, the Committee on Exhibitions were instructed to take the necessary steps to hold an Exhibition of American Manufactures next Fall, agreeably to their recommendation this evening.

New candidates for membership in the Institute (3) were proposed, and the candidates (8) proposed at the last meeting were duly elected.

Dr. Rand exhibited a model of the form of lightning rod proposed by Mr. J. L. Gatchell, and explained that no novelty was claimed for the rod, except the combination in one of all the means which experience and theory had shown to be most effective in producing the required protection. The rod terminates above in a platina point, secured upon a similar point upon the rod itself, and surrounded by a brush or row of copper points (as proposed and applied by Dr. Hare,) pointing outwards at an angle of about 45°, and secured at their bases into a ball of zinc screwed or soldered upon the rod; this combination of metals being used to prevent the rusting of the copper. The separate joints of the rod are to be secured by screwing, and pass through glass insulators, (not, as the inventor states, from any impression of the practical importance of such insulation, but in deference to the time-honored prejudices of the people.) At the lower end, again, the rod terminates on the level of the ground in a zinc ball, from which a number of copper rods pass down to water. This arrangement being adopted to prevent the rusting off of the rod, which not unfrequently takes place where iron is used just below the surface of the ground.

Prof. Frazer took the opportunity now afforded at the opening of the season most abundant in thunder-storms, to call the attention of the members to the true theory of the protection afforded by the lightning rod, which, notwithstanding all that had been done on the subject, seemed to be less understood among us than in the days of Franklin. He cited the experiment of Prof. Henry, *Proceedings Am. Phil. Soc.*, vol. iv, p. 265,)

by which it was shown that the rod was under the influence of the approaching cloud while yet at a great distance, (20 miles,) and hence showed the value of Dr. Hare's brush, which presents points directly towards the approaching cloud, whilst the upright extremity of the rod is prevented from acting. He also called attention to the great importance of a perfect conducting medium between the point and the moist earth, since the current through the rod, at the commencement of the action, must be exceedingly feeble, and therefore liable to be interrupted by the slightest break. This he considered as the prominent defect in the rod of Mr. Armitage, at least as put up in this neighborhood. The same fact of the inductive action of the rod while the cloud was at a great distance, and the consequent feebleness of the current produced, explained the importance of having a sufficient cross-section of the conductor, and the fallacy of depending upon mere surface; for although it appears that electricity of tension passes exclusively on the surface of conductors, (Henry, *Proc. Am. Phil. Soc.*, vol. iv, p. 179,) yet the galvanic current, which more nearly resembles the case under consideration, passes more freely as the area of cross-section is increased. He also called the attention of the members to the cases where a lightning rod has been known to be struck, that is, to receive a perceptible spark; and doubted whether in every case where this had been seen, a careful examination would not show a want of perfect conduction somewhere in the apparatus, and a consequent loss of the first and important inductive influence of the rod. This interruption he explained as most likely to occur by the rusting of the rod just below its entrance into the ground, and therefore considered the modification shown to-night as an improvement, inasmuch as it tended to prevent such an accident.

In reference to the insulation of the rod, Prof. Frazer considered it as entirely unimportant, except in cases where the building contained masses of metal, which should always be connected with the rod, in order to prevent the lateral shock.

Dr. Henry Hartshorne made the following remarks on the use of hydrogen as a calorific agent: The practicability and convenience of cooking and warming rooms or houses by gas, has been proved by numerous and sufficient trials. Its advantages over the ordinary employment of anthracite are obviously immense, except in the one item of *expense*. Those interested in the subject, have, therefore, been waiting in anticipation of a possible reduction in the price of gas. According to a calculation based upon statements made by Mr. Mayer, who has devised and put in use an excellent gas-cooking apparatus, it would require the reduction of gas to *one-half* its present cost to the consumer, in order to make its use in ranges and stoves as economical as that of coal. If gas were but $1·00 per thousand feet, the end would be gained.

But instead of reduction, a proposition has been recently made in the City Councils to *increase* the price of gas, on account of the greater present expense of the materials from which it is made. In view of this fact, and of the very high price of the coal used for domestic purposes, two questions are very naturally suggested: 1. Can a *cheaper* quality of the ordinary luminous gas be made, containing less carbon, and therefore unfit for light, but well adapted for calorific use? 2. If that be impracti-

cable, cannot some *other* gas be substituted for this purpose, as, for instance, hydrogen?

If either of these inquiries may be answered in the affirmative, it will have an important bearing on the interests of all householders. For, if light is an object of consequence, heat is still more indispensable; if light ever has been and must be expensive, heat for cooking and warming our domicils must ever require a still greater expenditure. The contrast between the old-fashioned, dull, and disagreeable glimmering of oil lamps and the delightful convenience of gas, is not by any means so great as would be the change from the time-reconciled use of coal-bins, coal-scuttles, shovels, and ash barrels, to the clean and comfortable substitute of simple gas-burners arranged in Mr. Mayer's stoves.

Putting aside, for the present, the question as to the possibility of making a cheap hydro-carbonous gas for heating purposes, let us consider the subject of hydrogen, as this gas is known to produce more heat in burning than any other substance.

There are at least three ways of manufacturing hydrogen gas.

1. By decomposing water through the means of the voltaic battery.
2. By the action of dilute sulphuric acid upon zinc or iron filings.
3. By passing the vapor of water over iron filings heated to an intense redness, or over coke.

The first of these methods has, perhaps, the greatest scientific beauty. Take, for example, a Bunsen's battery of a large number of cells; immerse the wires in water, the vessel containing which is divided by a septum into two parts; at the one pole will be given off hydrogen—at the other oxygen gas, in the proportion of two volumes to one. The gases may be collected in separate reservoirs, and rejoined in a jet at the desired place, on the plan of Dr. Hare's compound blow pipe. The most intense heat can thus be generated.

Unless, however, as Prof. Frazer has suggested, some improvement in the adaptation of the battery be obtained, so as to make the residue of the process available in some way, this plan of producing heat appears to be outside of the pale of *economy*.

With regard to the second method, the same objection would probably apply; a considerable amount of zinc or iron, as well as of sulphuric acid, being consumed in the process, and the resulting compound having but little value.

As to the third method, Dr. Kennedy informs us that in some parts of New England, hydrogen gas is manufactured by passing steam over heated iron filings, in order to *dilute* a luminous gas made from rosin. The substitution of coke for the iron filings has been devised by M. Gaillard, of Paris, who constructed a burner in which a jet of hydrogen made luminous a platinum wick; and the expense of this process, apart from the platinum, Dr. Rand believes to have been but 30 cents per thousand feet. The experiment has been repeated, in part at least, at the gas-works in this city. Now, if the cost of hydrogen used as a calorific gas be but 30 cents per thousand feet at the gas-holder, it will be an interesting inquiry easily solved by those familiar with gas manufacture, at what cost the same gas can be furnished, through main, pipes, and metres, *to the consumer?*

This, therefore, is the question intended to be suggested by these remarks; and, with a view of eliciting important information with regard to it, I make the following distinct proposition:

I propose, as the most convenient and desirable mode of supplying heat for cooking and warming purposes, the use of *hydrogen gas*, manufactured by passing the vapor of water over coke at a sufficient temperature, distributed through apparatus similar to that now in use for luminous gas, and applied by means of stoves, heaters, and ranges of such construction as shall prove, upon trial, to be the best.

I submit that if this can be done at a cost to the consumer of not more than $1·00 per thousand cubic feet, it will be equal in economy to the ordinary use of anthracite, and vastly superior in comfort, cleanliness and convenience. One very great advantage, affecting even the health is, that hydrogen produces *only water* in burning. The objection apparent at first sight in regard to the necessity, were such a plan approved, of creating new works, pipes, metres, &c., for the calorific gas, in addition to those already laid for the luminous carbo-hydrogen, is really null. The whole matter turns upon the question of expense. If it *pays*, it should be done, precisely as all who can afford it have pipes with warm water to supply their bath rooms, with none the less readiness because they already have had cold water pipes in the same place.

The remarks gave rise to an interesting discussion, which was participated in by Prof. Frazer, Dr. Rand, Dr. Hartshorne, Dr. Kennedy, and Mr. Williams. At the request of Dr. Hartshorne, the subject was referred to the Committee on Science and the Arts for investigation.

BIBLIOGRAPHICAL NOTICE.

Field-Book for Railroad Engineers, containing Formulae for Laying out Curves, determining Frog Angles, Leveling, Calculating Earth Work, &c., &c.; together with Tables of Radii, Ordinates, Deflexions, Long Chords, Magnetic Variations, Logarithms, Logarithmic and Natural Sines, Tangents, &c., &c. By John B. Henck, A. M., Civil Engineer. New York: D. Appleton & Co.

We quote at full length, as the most convenient mode of announcing its aims and contents, the title page of a pocket volume just issued from the press. The growing importance of the engineering profession in this country, and the numbers engaged in it or aspiring to its honors, are well indicated by the works of this character which have been published of late years for their especial convenience. Those of Haswell, Scribner, and Trautwine, may be particularly mentioned as useful works, all like this, in pocket form.

Mr. Henck's book is evidently by a practical man, who understands the wants of the profession. It has much merit, and we commend it cordially, not only to beginners, who will find it an excellent text book, but also to experienced assistant engineers, as an admirable compendium of rules and tables, which will save them a great deal of trouble in the field, as well as the office. We know of no single book which could supply its place.

E. M.

INDEX.

LIST OF AMERICAN PATENTS, WITH REMARKS, &c.

DESIGNS.

January, 1854.

RE-ISSUES.

DESIGNS.

ADDITIONAL IMPROVEMENTS.

RE-ISSUES.

DESIGNS.